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Draft Environmental Impact Statement

Northern San Juan Basin Coal Bed Methane Project
Volume II











U.S. Department of Interior
Bureau of Land Management
San Juan Field Office

U.S. Department of Agriculture
Forest Service
San Juan National Forest

June 2004

MISSION STATEMENT

It is the mission of the Bureau of Land Management to sustain the health, diversity, and productivity of the public lands for the use and enjoyment of present and future generations.

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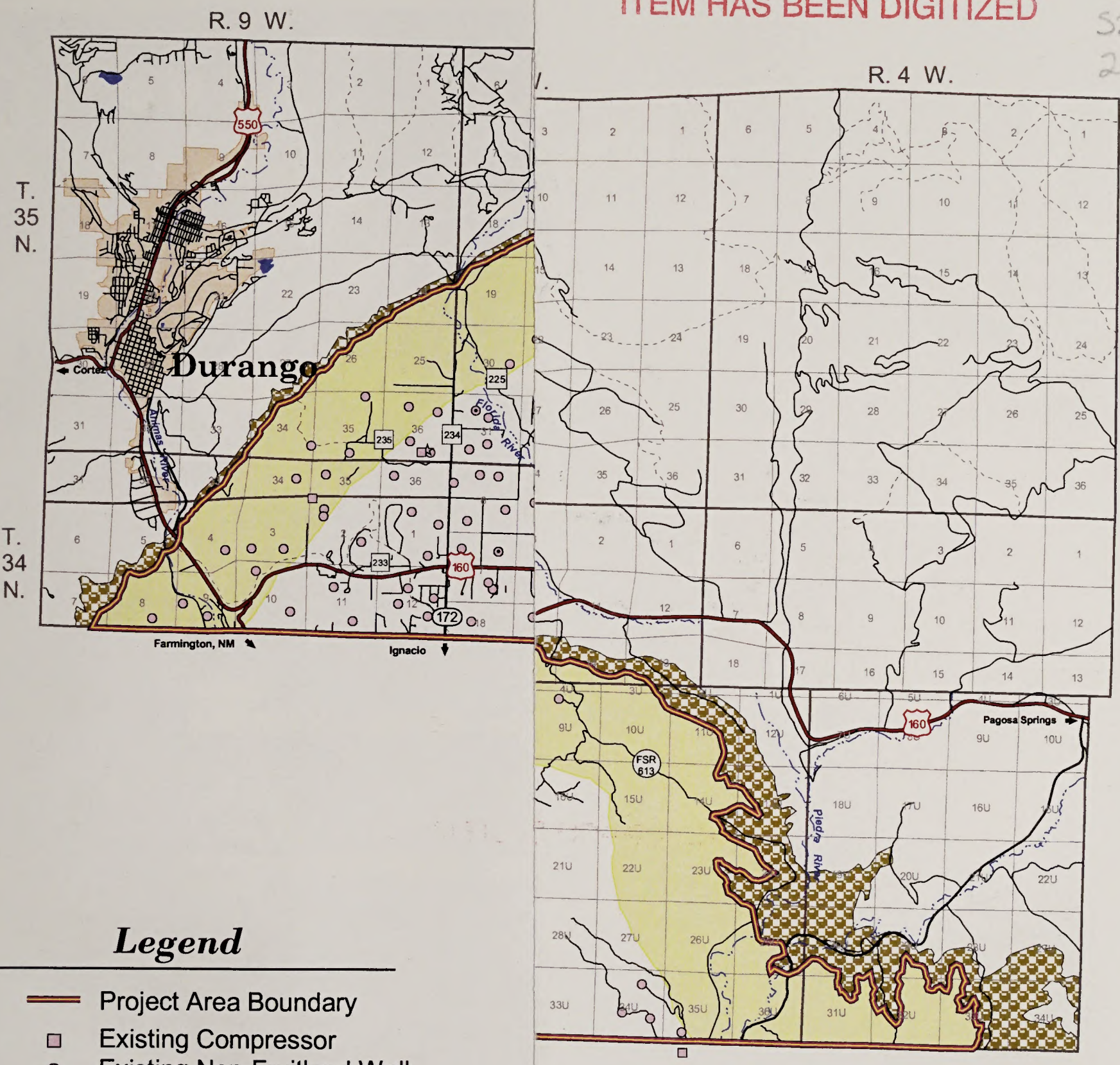
ITEM HAS BEEN DIGITIZED

#256804663

ID 880671167

ITEM HAS BEEN DIGITIZED

HD
243
.C6
S26
2004
v.2



Legend

- Project Area Boundary
- Existing Compressor
- Existing Non-Fruitland Well
- Existing Fruitland Well
- Existing Disposal Well
- U.S. Highway
- Primary Road
- Secondary Road
- Trail
- Lake/Reservoir
- Stream/River
- Municipal Area
- Buffer Zone (1.5 Miles from top of Frui
- Fruitland Formation Outcrop

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dy, 1998.
rtation

NORTHERN SAN JUAN BASIN CBM EIS

FIGURE 3-1
OUTCROP AND BASIN INTERIOR

ANALYSIS AREA: LA PLATA & ARCHULETA COUNTIES, COLORADO

Date: 04/01/04	ArcView File: C:\994-sanjuan\proj1.apr
	Prepared By: JG

MISSION STATEMENT

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HD 243 .C6 S26 2004 v.2

ITEM HAS BEEN DIGITIZED

R. 9 W. R. 8 W. R. 7 W. R. 6 W. R. 5 W. R. 4 W.

T. 35 N.

T. 34 N.

T. 34 NU.

Durango

Bayfield

Gem Village

Pagosa Springs

Farmington, NM

Ignacio

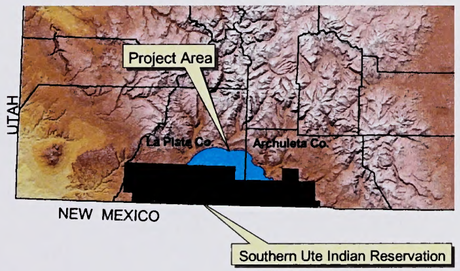
Cortez

Southern Ute Indian Reservation

LA PLATA COUNTY
ARCHULETA COUNTY

Los Pinos River
Florida River
Animas River
Beaver Creek
Saulis Creek
Ute Creek
Spring Creek
Piedra River

160 550 172 233 234 235 225 223 228 502 503 504 505 501 527 FSR 608 FSR 755 FSR 743 FSR 756 FSR 813 FSR 537



Legend

- Project Area Boundary
- Existing Compressor
- Existing Non-Fruitland Well
- Existing Fruitland Well
- Existing Disposal Well
- U.S. Highway
- Primary Road
- Secondary Road
- Trail
- Lake/Reservoir
- Stream/River
- Municipal Area
- Buffer Zone (1.5 Miles from top of Fruitland Outcrop)
- Fruitland Formation Outcrop

N W E S

2 0 2 4 6 8 *Kilometers*

2 0 2 4 6 8 *Miles*

La Plata County transportation data provided by the La Plata County Transportation Study, 1998. Hydrologic and Archuleta County transportation features extracted from 1:100,000 USGS SDTS data.

Transverse Mercator Projection
1927 North American Datum
Zone 13

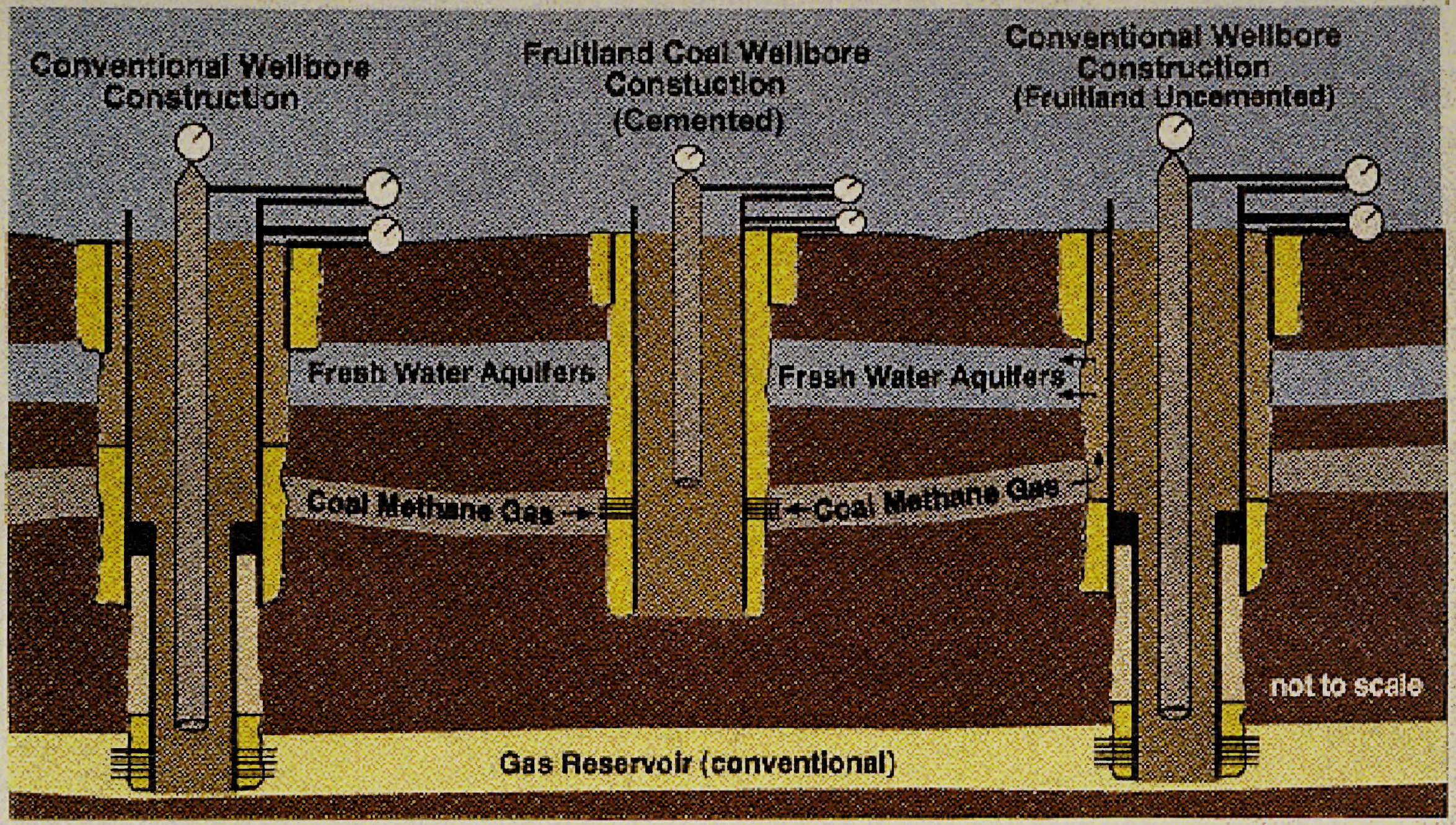
NORTHERN SAN JUAN BASIN CBM EIS

FIGURE 3-1
OUTCROP AND BASIN INTERIOR

ANALYSIS AREA: LA PLATA & ARCHULETA COUNTIES, COLORADO

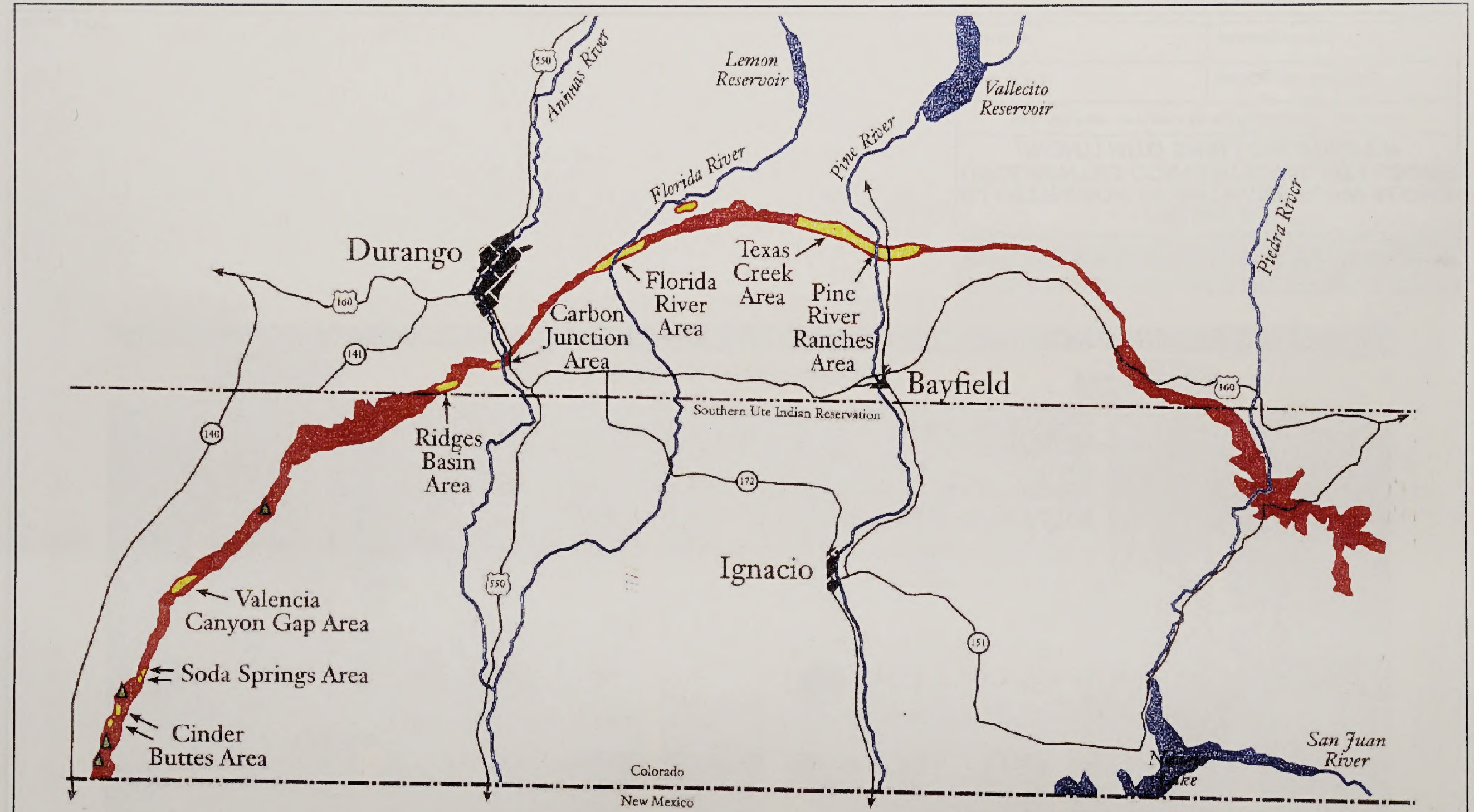
Date: 04/01/04 | ArcView File: C:\994-sanjuan\proj1.apr

Prepared By: JG



NORTHERN SAN JUAN BASIN CBM EIS	
FIGURE 3-2 *ILLUSTRATION OF METHANE FLOW ALONG UNCEMENTED CONVENTIONAL WELLBORE (RIGHT) INTO SHALLOW AQUIFER*	
ANALYSIS AREA: LA PLATA & ARCHULETA COUNTIES, COLORADO	
DATE: 04.01.04	AUTOCAD FILE: 994figs.dwg
SCALE: nts	PREPARED BY: ETC

Source: SJNF



LEGEND

- Fruitland Formation
- Methane Seeps
- Coal Fires

N W E S

0 6 12

Miles

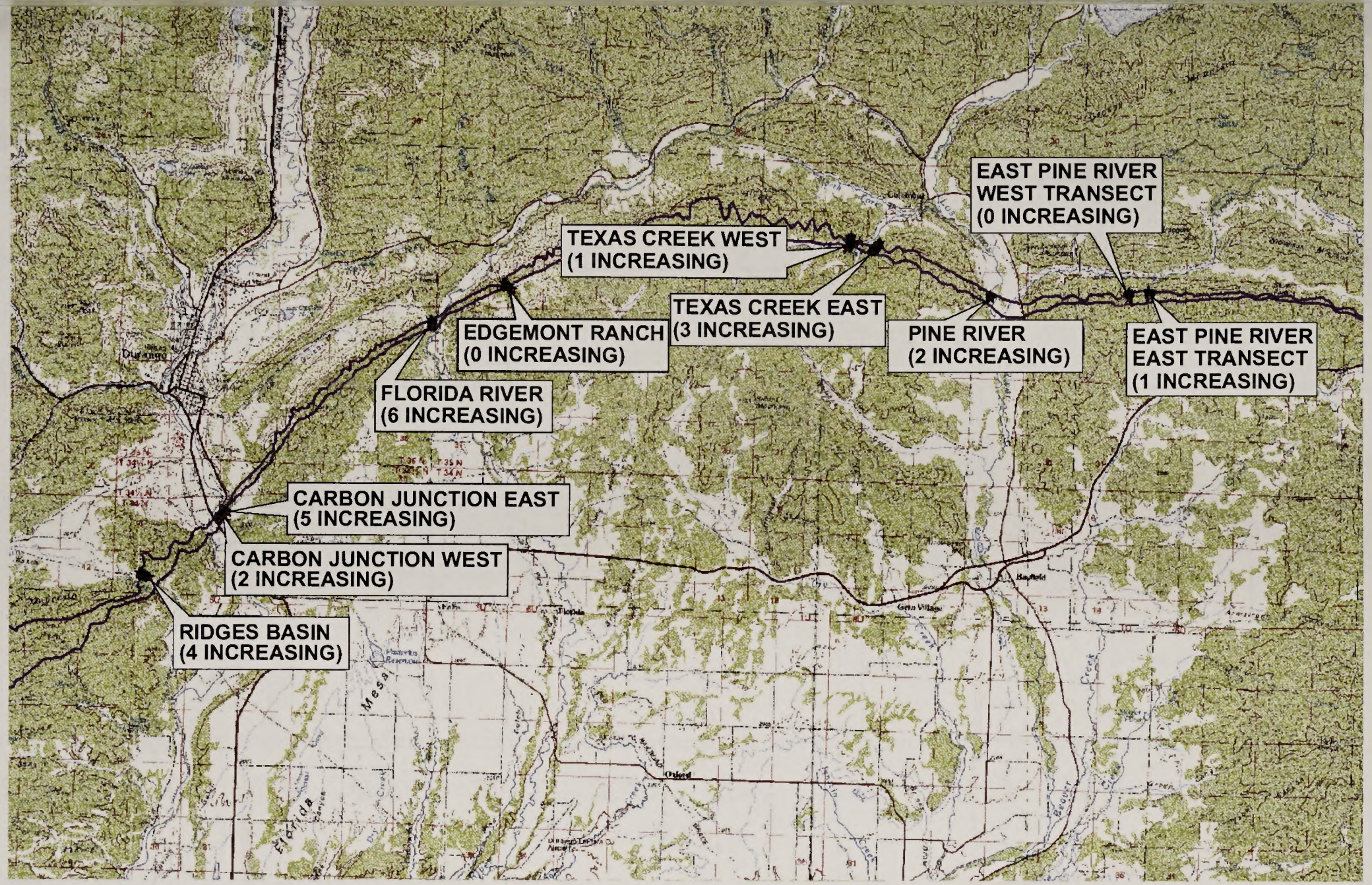
Source: BLM 2000b

NORTHERN SAN JUAN BASIN CBM EIS

FIGURE 3-3
UNDERGROUND COAL FIRE AND GAS SEEP LOCATIONS

ANALYSIS AREA: LA PLATA & ARCHULETA COUNTIES, COLORADO

DATE: 04.01.04	AUTOCAD FILE: 994 figure 3-3.dwg
SCALE: As Noted	PREPARED BY: ETC



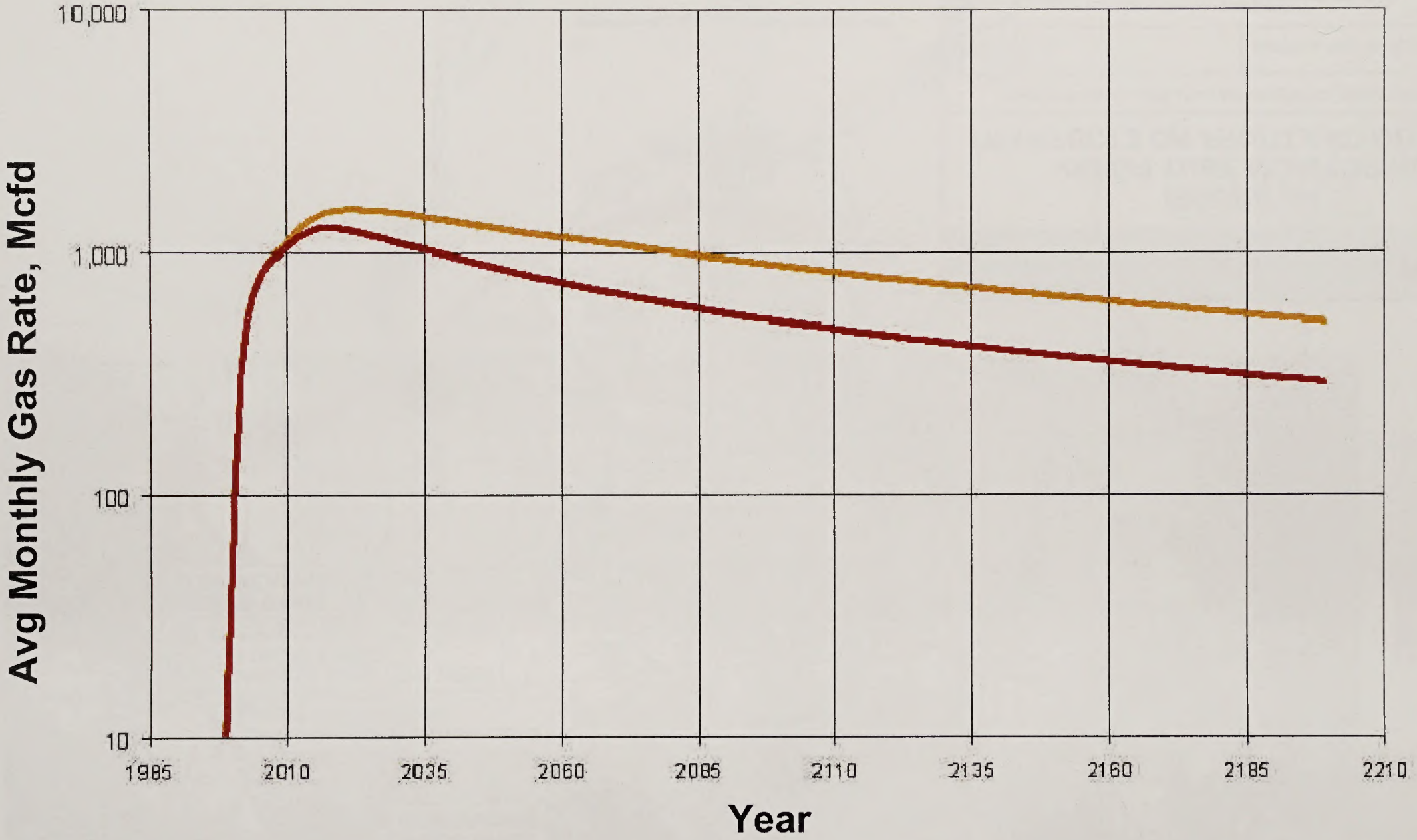


0 3 6

Miles

Source: SJNF

NORTHERN SAN JUAN BASIN CBM EIS	
FIGURE 3-4 VAPOR TUBE MONITORING TRANSECTS ON FRUITLAND OUTCROP	
ANALYSIS AREA: LA PLATA & ARCHULETA COUNTIES, COLORADO	
DATE: 04.01.04	AUTOCAD FILE: 994figs.dwg
SCALE: As Noted	PREPARED BY: ETC



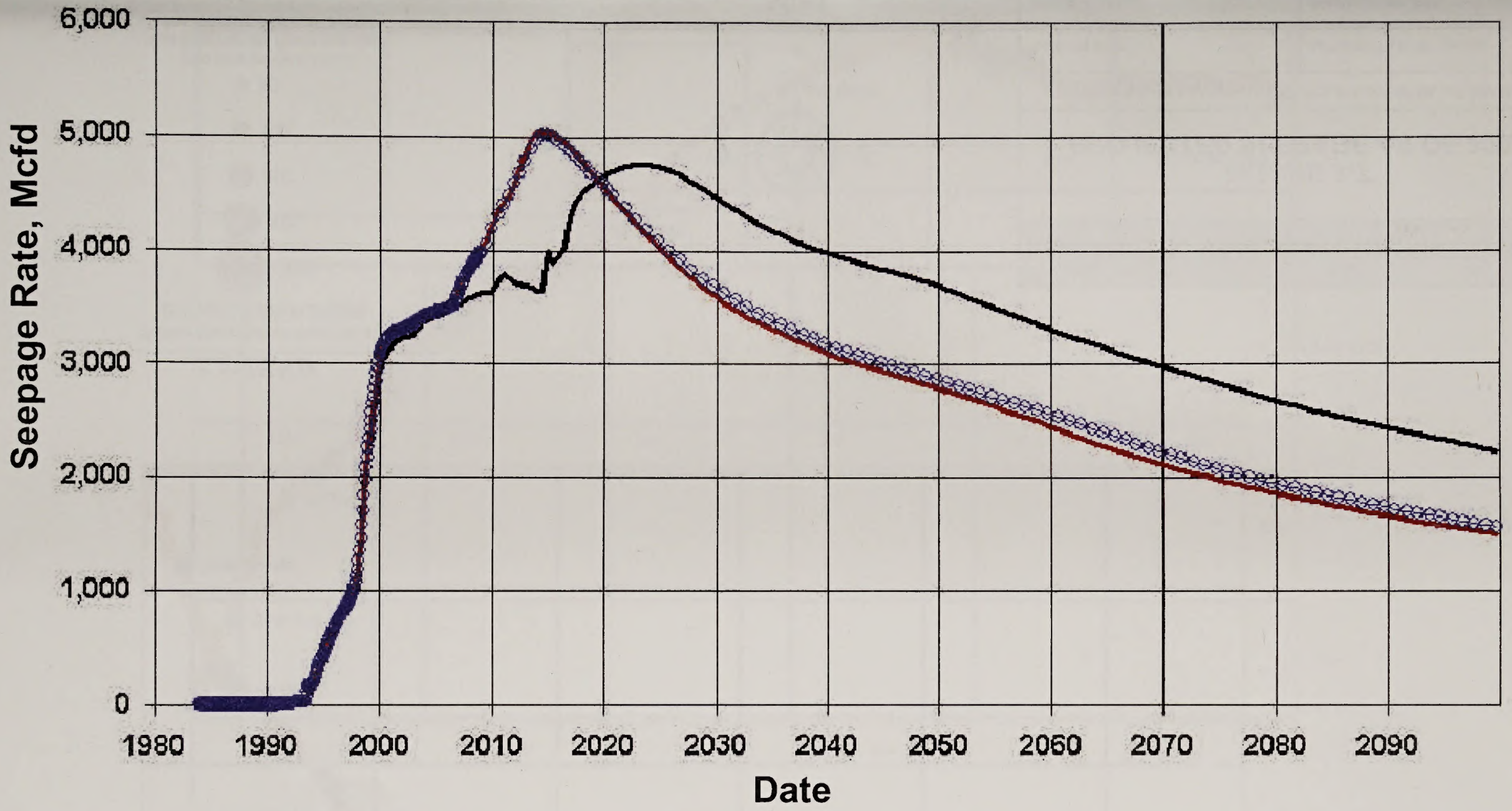
LEGEND

Without Infill Wells

With Infill Wells

NORTHERN SAN JUAN BASIN CBM EIS	
FIGURE 3-5 ***3M SIMULATION RESULTS - OUTCROP METHANE SEEPAGE IN AREA B***	
ANALYSIS AREA: LA PLATA & ARCHULETA COUNTIES, COLORADO	
DATE: 04.01.04	AUTOCAD FILE: 994GRAPHS.DWG
SCALE: NTS	PREPARED BY: ETC

Source: Questa 2000

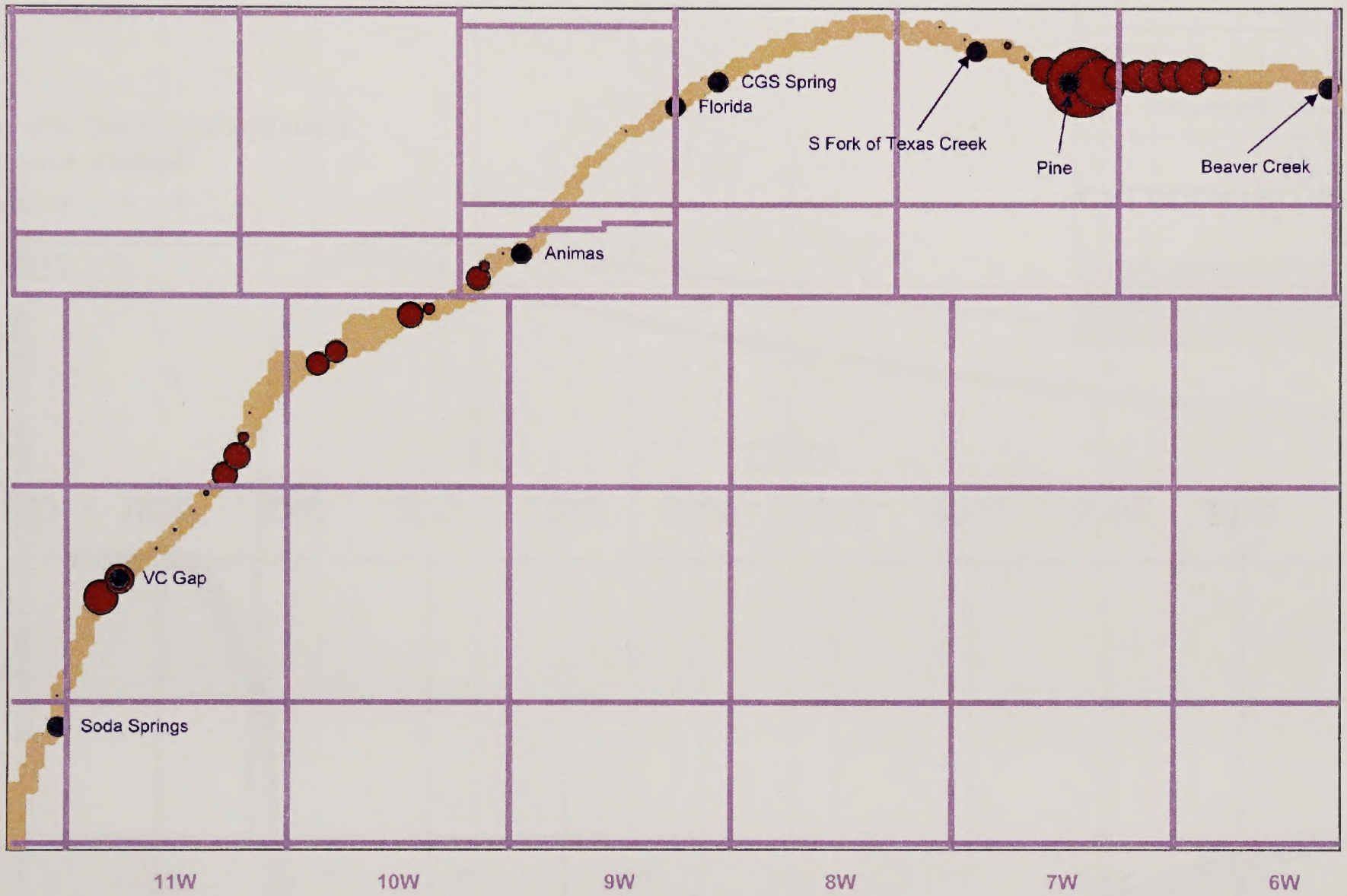


LEGEND

- 320- Acre Spacing
- 160- Acre Spacing
- 160- Acre Staged Development

Source: Questa 2002

NORTHERN SAN JUAN BASIN CBM EIS	
FIGURE 3-6 ***CALCULATED METHANE SEEPAGE RATES AT THE OUTCROP***	
ANALYSIS AREA: LA PLATA & ARCHULETA COUNTIES, COLORADO	
DATE: 04.01.04	AUTOCAD FILE: 994GRAPHS.DWG
SCALE: NTS	PREPARED BY: ETC

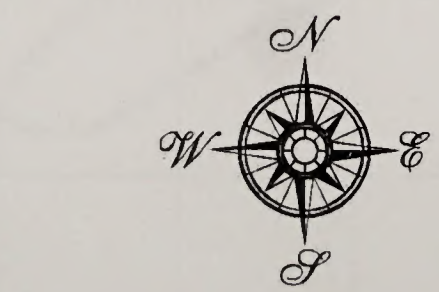


LEGEND

Bubble Sizes Reflect Seep Rate in
Mcfd per 1/2 mile of Outcrop

1000
500
200
100
50

Red Dots Indicate Seeps,
Blue Dots Indicate Rivers and Gaps,
Tan Indicates Fruitland Outcrop



0 6 12

Miles

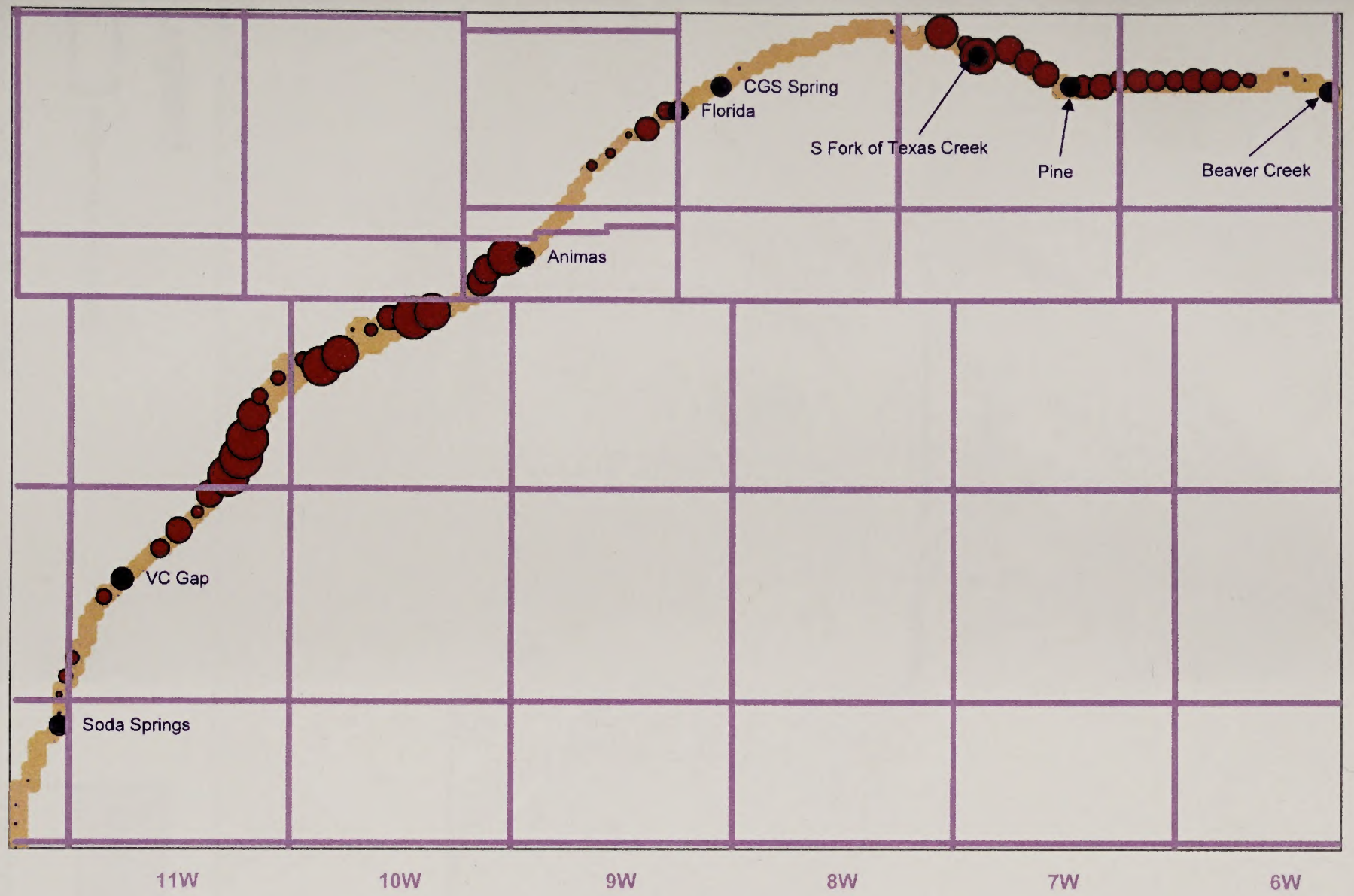
Source: SJNF

NORTHERN SAN JUAN BASIN CBM EIS

FIGURE 3-7
PROJECTED SEEPAGE AS OF 2000

ANALYSIS AREA: LA PLATA & ARCHULETA COUNTIES, COLORADO

DATE: 04.01.04	AUTOCAD FILE: 994figs.dwg
SCALE: As Noted	PREPARED BY: ETC



LEGEND

Bubble Sizes Reflect Seep Rate in
Mcfd per 1/2 mile of Outcrop

1000
500
200
100
50

Red Dots Indicate Seeps,
Blue Dots Indicate Rivers and Gaps,
Tan Indicates Fruitland Outcrop

Source: SJNF

N
W
E
S

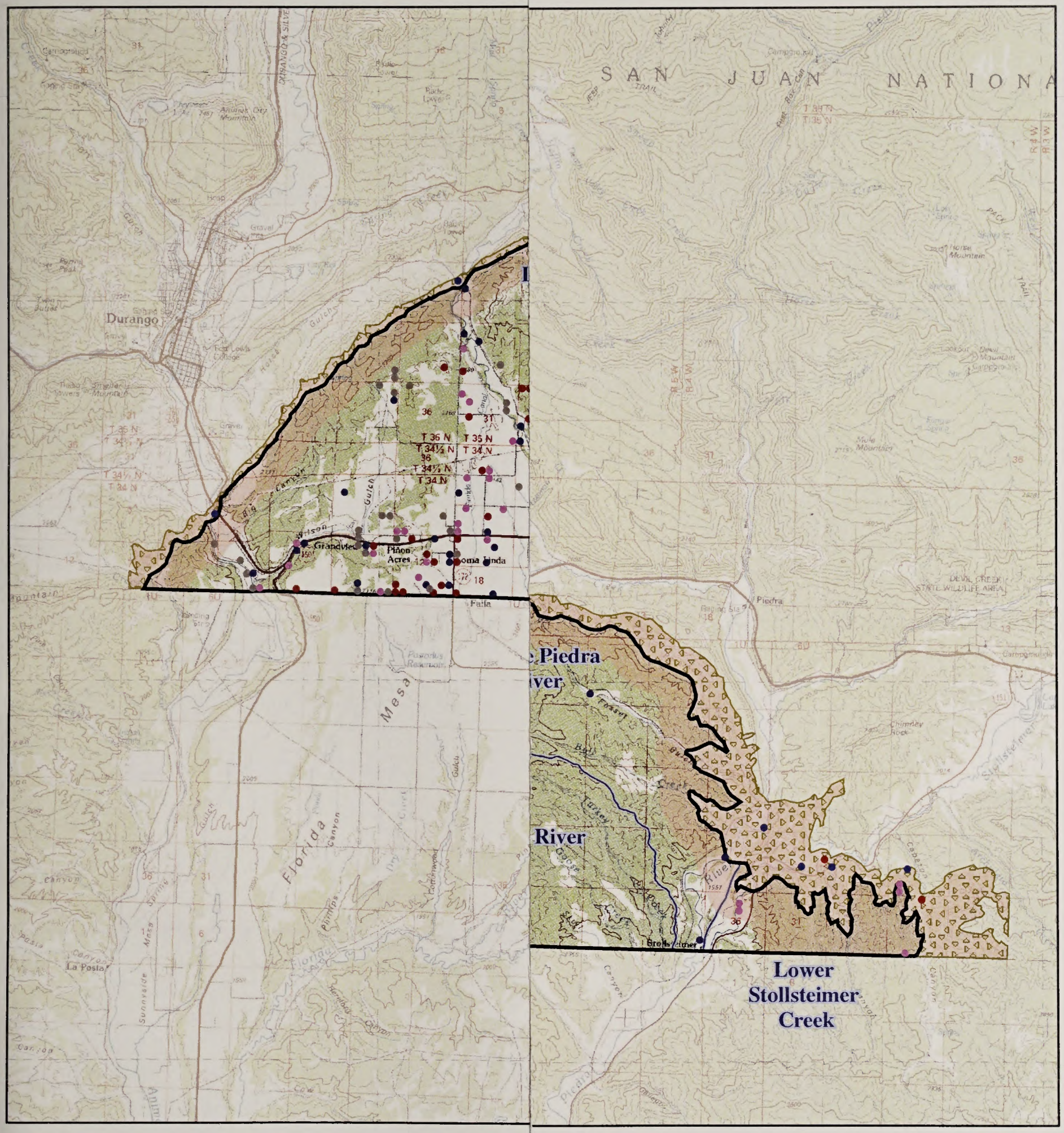
0 6 12
Miles

NORTHERN SAN JUAN BASIN CBM EIS

FIGURE 3-8
PROJECTED SEEPAGE AS OF 2030

ANALYSIS AREA: LA PLATA & ARCHULETA COUNTIES, COLORADO

DATE: 04.01.04	AUTOCAD FILE: 994figs.dwg
SCALE: As Noted	PREPARED BY: ETC



Legend

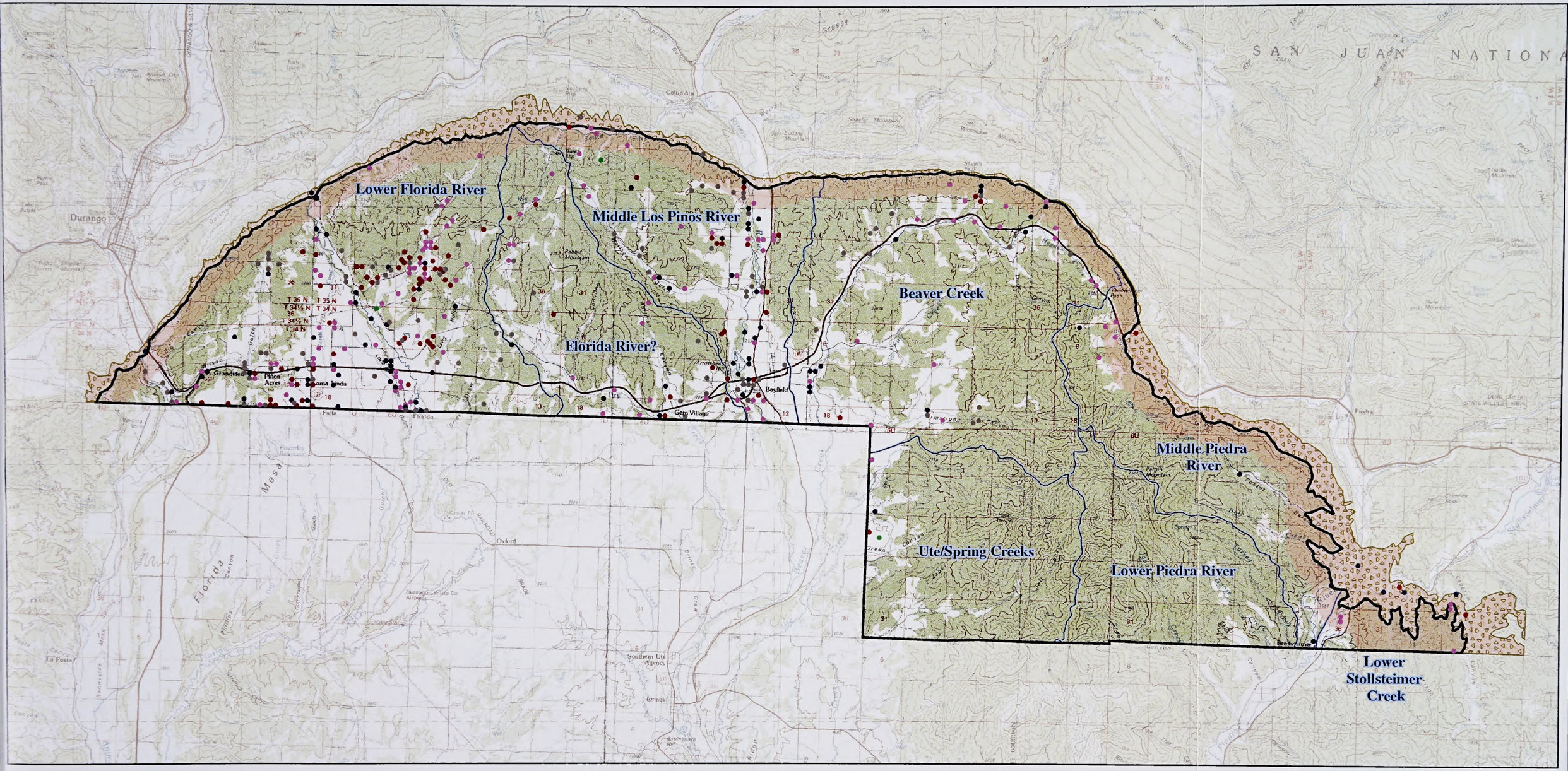
- Project Area Boundary
- HUC5 Watershed Boundary
- Fruitland Formation Outcrop
- Fruitland Formation Outcrop Plus Half-mile Buffer

Use Cate
- Dom
- Irriga
- Stoc
- Mult
- Othe

NORTHERN SAN JUAN BASIN CBM EIS

FIGURE 3-9
DISTRIBUTION OF DOMESTIC WELLS IN THE PROJECT AREA AND OUTCROP OF THE FRUITLAND FORMATION

ANALYSIS AREA: La Plata and Archuleta Counties, CO	
Date: 04/01/04	File: I:\..\994_san_juan\..\water_rights.mxd
Drawn By: MSH	Scale 1:150,000



Legend

- Project Area Boundary
- HUC5 Watershed Boundary
- Fruitland Formation Outcrop
- Fruitland Formation Outcrop Plus Half-mile Buffer

Use Category

- Domestic
- Irrigation
- Stock
- Multiple Use
- Other

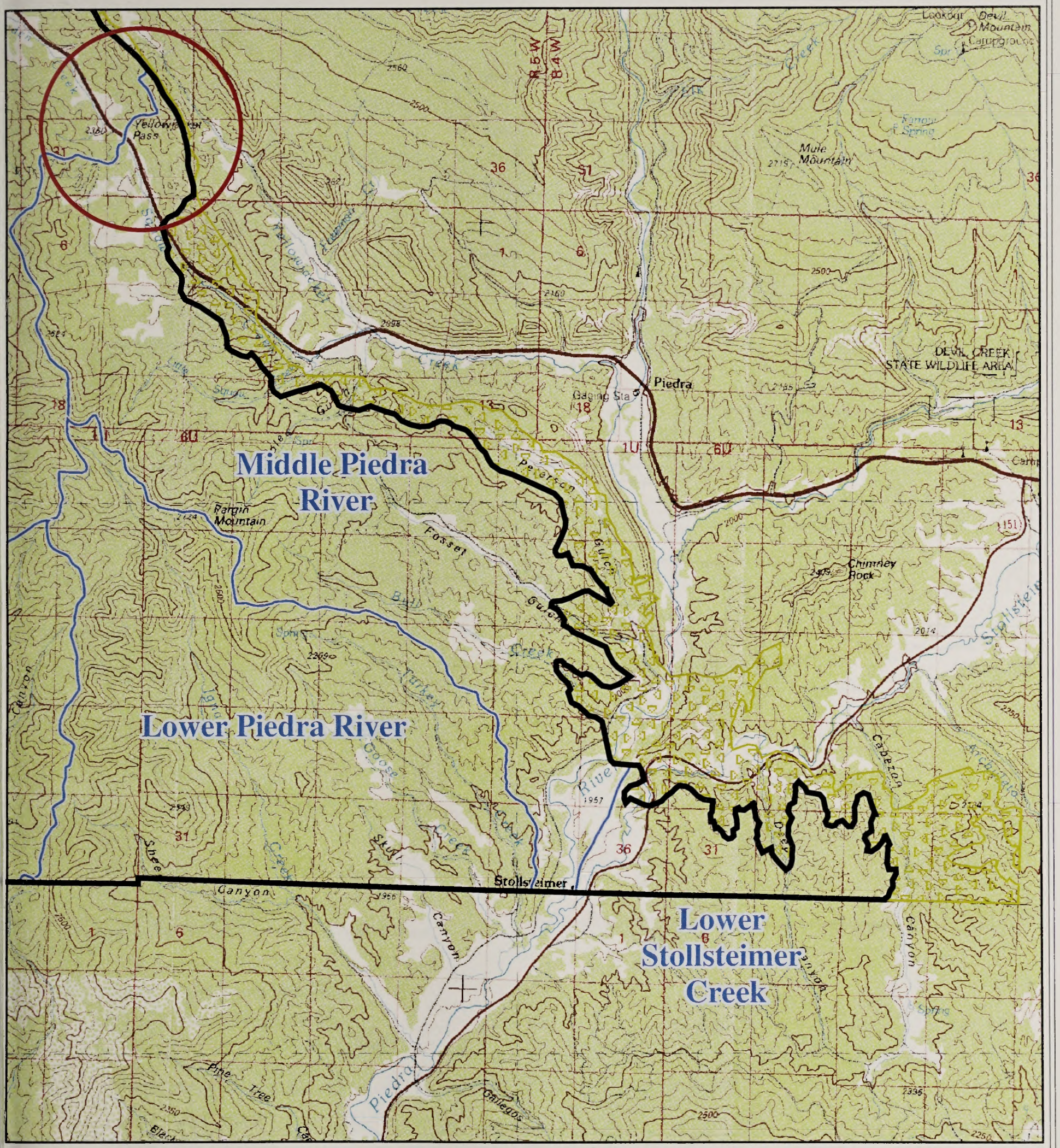
N W E S

0 1 2 4 6 8 Miles

NORTHERN SAN JUAN BASIN CBM EIS

FIGURE 3-9
DISTRIBUTION OF DOMESTIC WELLS IN THE PROJECT AREA AND OUTCROP OF THE FRUITLAND FORMATION

ANALYSIS AREA: La Plata and Archuleta Counties, CO	
Date: 04/01/04	File: I:\..\994_san_juan\..\water_rights.mxd
Drawn By: MSH	Scale 1:150,000



Legend

- Project Area Boundary
- HUC5 Watershed Boundary
- Fruitland Formation Outcrop
- Area of Discussion

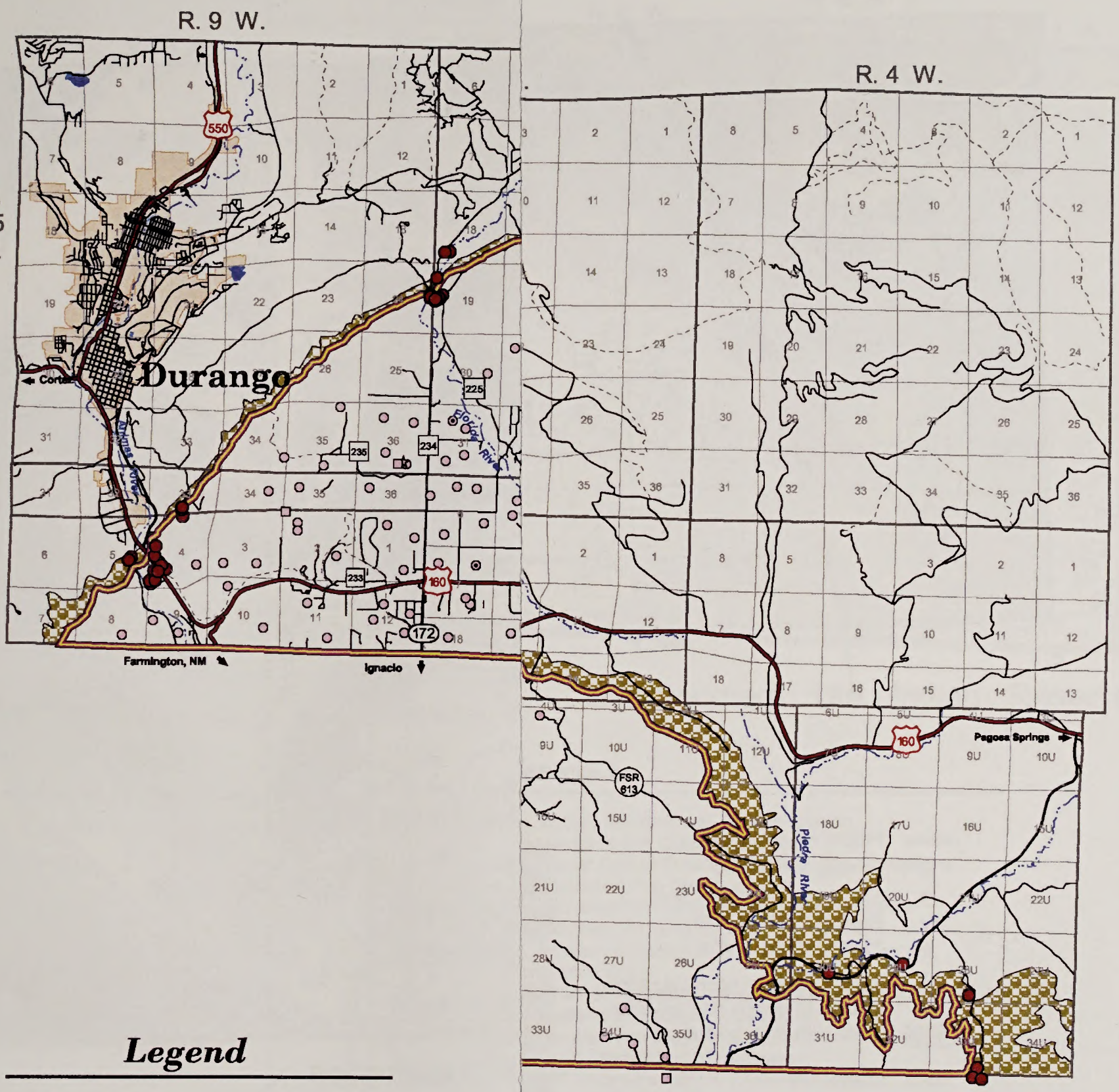
N W E S

0 1 2 4 Miles

NORTHERN SAN JUAN BASIN CBM EIS

FIGURE 3-10
EASTERN PROJECT AREA--
SQUAW CREEK AND PIEDRA RIVER

ANALYSIS AREA: La Plata and Archuleta Counties, CO	
Date: 04/01/04	File: I:\..\eastern_watersheds.mxd
Drawn By: MSH	Scale 1:72,000



Legend

- Building Location
- Project Area Boundary
- Existing Compressor
- Existing Non-Fruitland Well
- Existing Fruitland Well
- Existing Disposal Well
- County Line
- U.S. Highway
- Primary Road
- Secondary Road
- Trail
- Lake/Reservoir
- Stream/River
- Municipal Area
- Fruitland Formation Outcrop

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udy, 1998.
ortation

database

NORTHERN SAN JUAN BASIN CBM EIS

FIGURE 3-11
BUILDINGS WITHIN 1/4 MILE OF THE FRUITLAND OUTCROP

ANALYSIS AREA: LA PLATA & ARCHULETA COUNTIES, COLORADO

Date: 04/01/04	ArcView File: C:\994-sanjuan\proj1.apr
	Prepared By: JG

R. 9 W. R. 8 W. R. 7 W. R. 6 W. R. 5 W. R. 4 W.

T. 35 N.

T. 34 N.

T. 34 NU.

Durango

Bayfield

Southern Ute Indian Reservation

Farmington, NM

Ignacio

Pagosa Springs

LA PLATA COUNTY / ARCHULETA COUNTY

Los Pinos River

Florida River

Lightner Creek

Stevens Creek

Ute Creek

Ignacio Creek

Spring Creek

Pine River

FSR 806

FSR 743

FSR 756

FSR 613

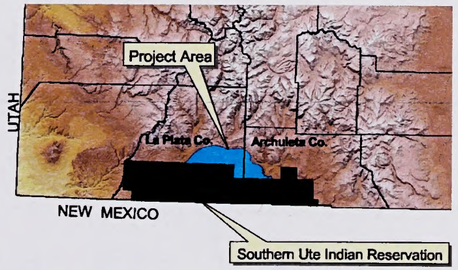
FSR 537

160

550

172

527



Legend

- Building Location
- Project Area Boundary
- Existing Compressor
- Existing Non-Fruitland Well
- Existing Fruitland Well
- Existing Disposal Well
- County Line
- U.S. Highway
- Primary Road
- Secondary Road
- Trail
- Lake/Reservoir
- Stream/River
- Municipal Area
- Fruitland Formation Outcrop

N W E S

2 0 2 4 6 8 *Kilometers*

2 0 2 4 6 8 *Miles*

La Plata County transportation data provided by the La Plata County Transportation Study, 1998. Hydrologic and Archuleta County transportation features extracted from 1:100,000 USGS SDTS data. Existing wells extracted from COGCC well database and edited by the BLM & USFS.

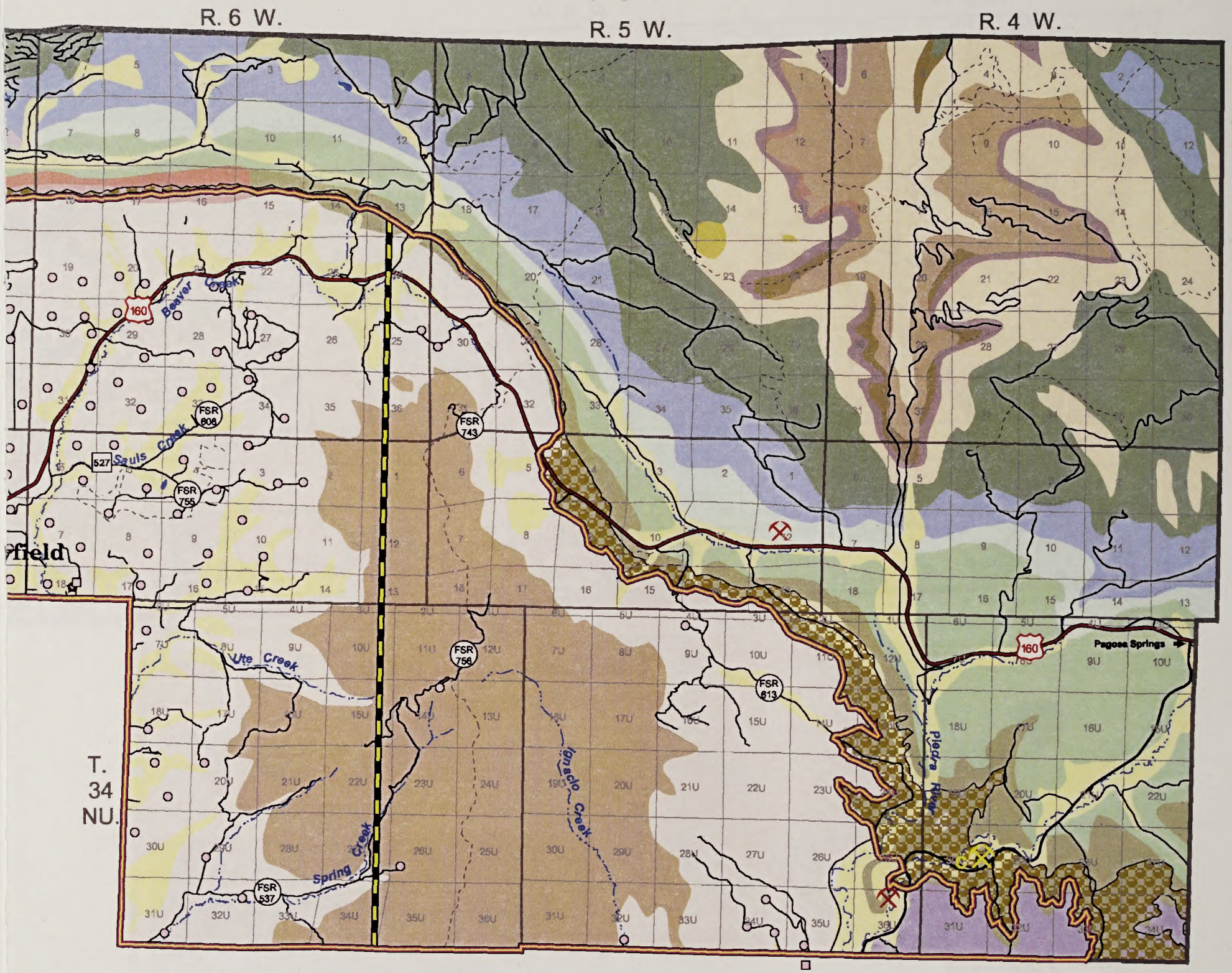
Transverse Mercator Projection
1927 North American Datum
Zone 13

NORTHERN SAN JUAN BASIN CBM EIS

FIGURE 3-11
BUILDINGS WITHIN 1/4 MILE OF THE FRUITLAND OUTCROP

ANALYSIS AREA: LA PLATA & ARCHULETA COUNTIES, COLORADO

Date: 04/01/04	ArcView File: C:\994-sanjuan\proj1.apr
	Prepared By: JG



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8 Kilometers

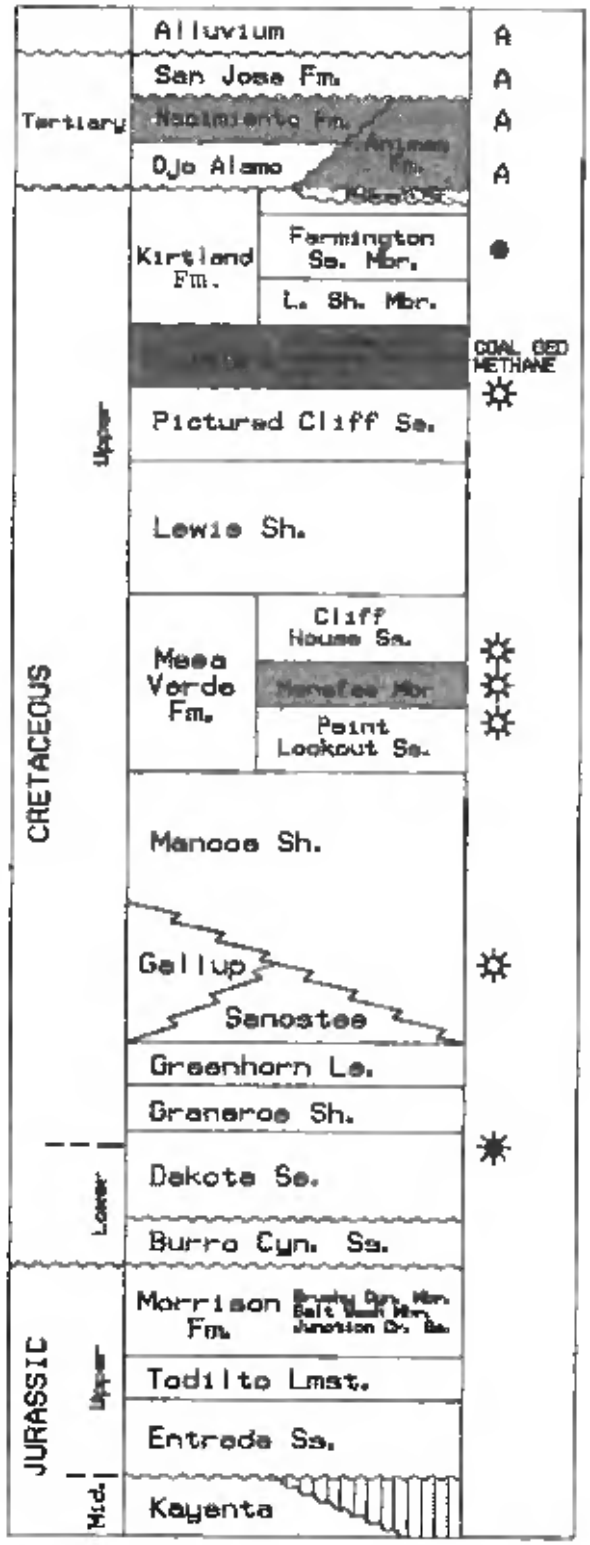
6 8 Miles

Transverse Mercator Projection
1927 North American Datum
Zone 13

NORTHERN SAN JUAN BASIN CBM EIS

FIGURE 3-12
SURFACE GEOLOGY

ANALYSIS AREA: LA PLATA & ARCHULETA COUNTIES, COLORADO	
Date: 04/01/04	ArcView File: C:\994-sanjuan\proj1.apr
	Prepared By: JG



LEGEND

- A — Aquifer
- ● — Oil
- ✷ — Oil and Gas
- ✲ — Gas

Note: Modified from Amoco, 1194, Figure 11

Source: BLM 2000b

NORTHERN SAN JUAN BASIN CBM EIS

FIGURE 3-13
NORTHERN SAN JUAN BASIN
STRATIGRAPHIC COLUMN

ANALYSIS AREA: LA PLATA & ARCHULETA COUNTIES, COLORADO	
DATE: 04.01.04	AUTOCAD FILE: 894 figs.dwg
SCALE: nts	PREPARED BY: EIC

R. 9 W. R. 8 W. R. 7 W. R. 6 W. R. 5 W. R. 4 W.

T. 35 N.

T. 34 N.

Durango

Bayfield

Southern Ute Indian Reservation

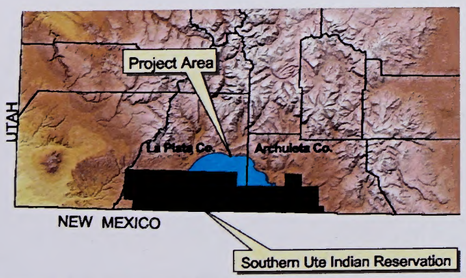
T. 34 NU.

Southern Ute Indian Reservation

Legend

- Project Area Boundary
- Existing Compressor
- Existing Non-Fruitland Well
- Existing Fruitland Well
- Existing Disposal Well
- Sand, Gravel, or Aggregate Mine
- Inactive Underground Coal Mine
- Inactive Coal Strip Mine
- County Line
- U.S. Highway
- Primary Road
- Secondary Road
- Trail
- Lake/Reservoir
- Stream/River
- Fruitland Formation Outcrop

- Modern Alluvium and Terrace Gravels
- Landslide and Colluvial Deposits
- Glacial Drift of Pinedale and Bull Lake Glaciations
- Nacimento Frm (Paleocene)
- San Jose Formation Blanco Basin Formation
- Laramide Intrusive Rocks
- Animas Formation
- Kirtland Shale
- Kirtland Fruitland And Pictured Cliffs Frms (Upper Cretaceous)
- Fruitland Frm (Upper Cretaceous)
- Menefee Frm (Upper Cretaceous)
- Lewis Shale (Upper Cretaceous)
- Cliff House Sandstone (Upper Cretaceous)
- Mesaverde Frm (Upper Cretaceous)
- Mancos Shale (Upper Cretaceous)
- Point Lookout Sandstone (Upper Cretaceous)
- Pictured Cliffs Sandstone (Upper Cretaceous)
- Dakota Sandstone And Burro Canyon Frm (Lower Cretaceous)
- Morrison Frm (Upper Jurassic)
- Morrison And Wanakah Frms
- Wanakah Frm (Upper Jurassic)
- Entrada Sandstone (Upper Jurassic)
- Dolores Frm (Upper Triassic)
- Cutler Frm (Lower Permian)
- Leadville, Ouray, Elbert, and Ignacio Formations
- Uncompahgre Frm (Precambrian) Quartzite



2 0 2 4 6 8 Kilometers

2 0 2 4 6 8 Miles

La Plata County transportation data provided by the La Plata County Transportation Study, 1998. Hydrologic and Archuleta County transportation features extracted from 1:100,000 USGS SDTS data. Existing wells extracted from COGCC well database and edited by BLM & USFS. Geology coverage extracted from Gregory Green's 1992 digitized version of the Geologic Map of Colorado (Tweto 1979). Mine locations digitized from 'Active Mine Operations In Colorado, 1996-97' (Lawson).

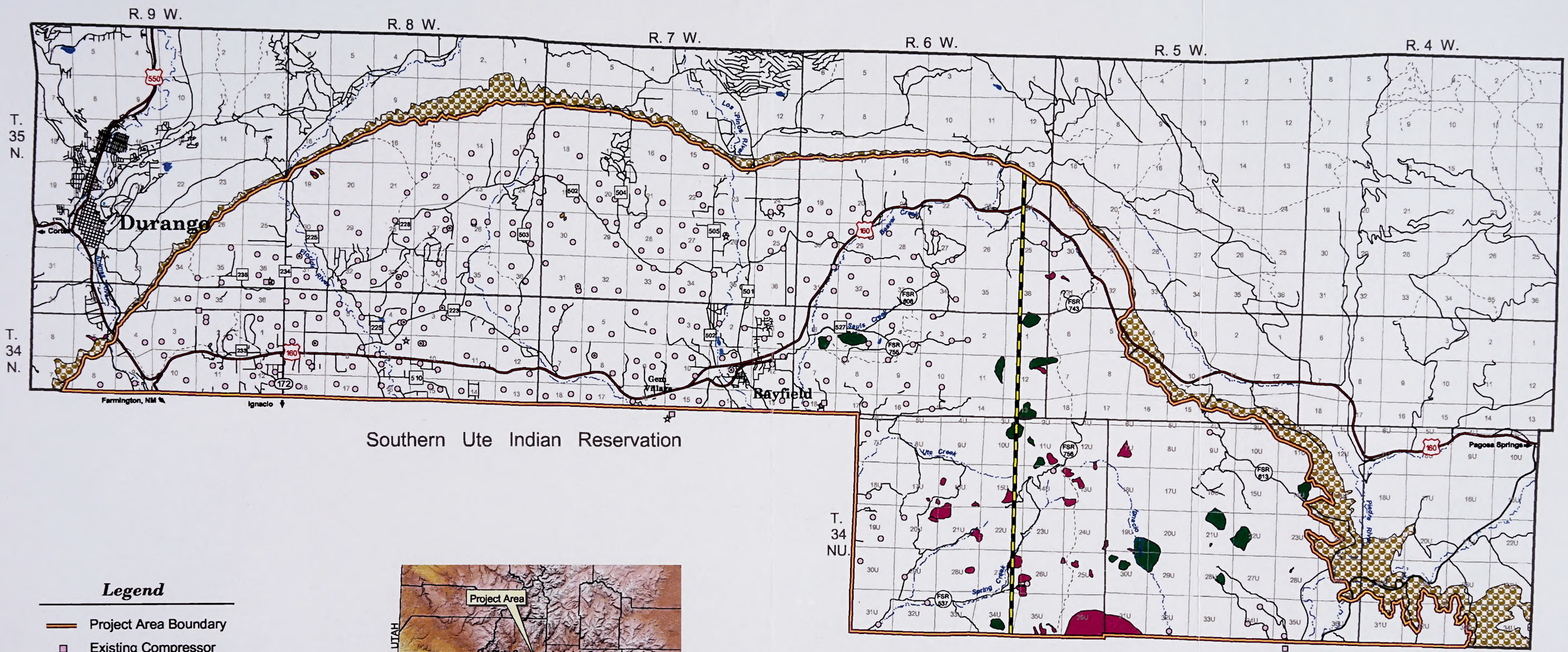
Transverse Mercator Projection
1927 North American Datum
Zone 13

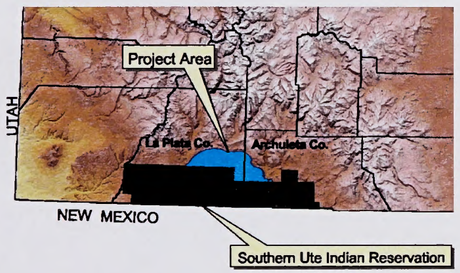
NORTHERN SAN JUAN BASIN CBM EIS

FIGURE 3-12
SURFACE GEOLOGY

ANALYSIS AREA: LA PLATA & ARCHULETA COUNTIES, COLORADO

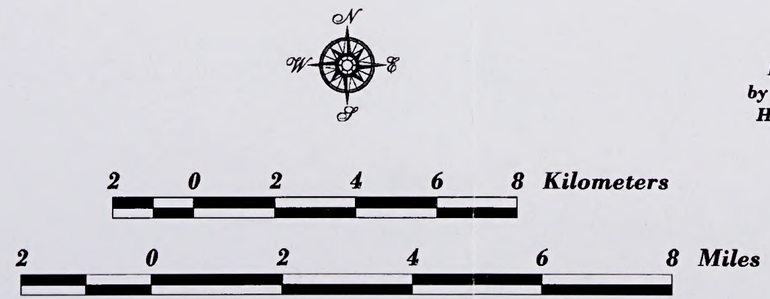
Date: 04/01/04	ArcView File: C:\694-sanjuan\proj1.apr
	Prepared By: JG





Legend

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- Existing Fruitland Well
- Existing Disposal Well
- County Line
- U.S. Highway
- Primary Road
- Secondary Road
- Trail
- Lake/Reservoir
- Stream/River
- Landslide Deposit - Colorado Geologic Survey Mapping
- Landslide Deposit - USFS Mapping
- Landslide Deposit - USGS Mapping
- Fruitland Formation Outcrop



Landslide data provided by the USFS.

La Plata County transportation data provided by the La Plata County Transportation Study, 1998. Hydrologic and Archuleta County transportation features extracted from 1:100,000 USGS SDTS data.
Existing wells extracted from COGCC well database and edited by the BLM & USFS.

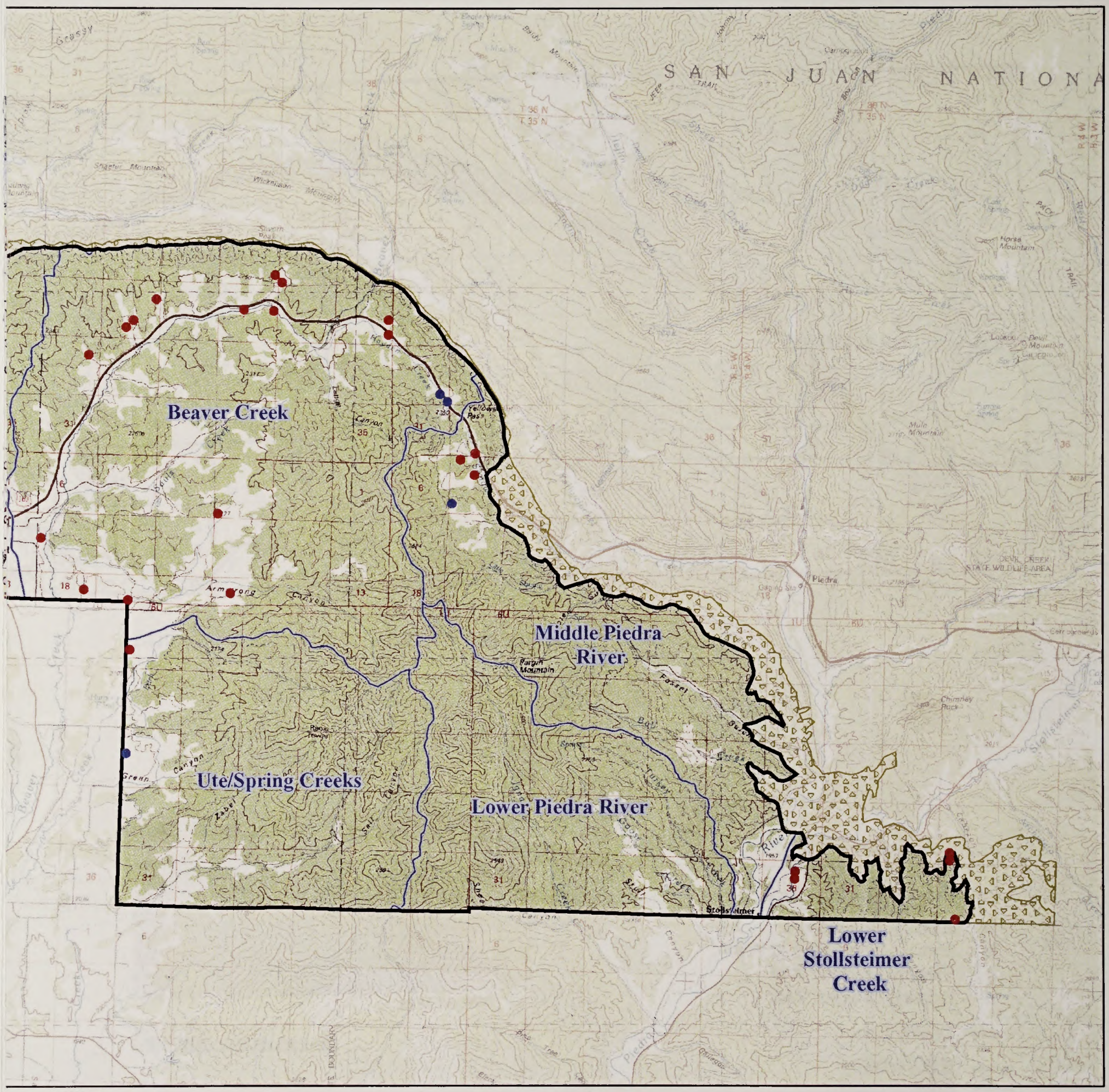
Transverse Mercator Projection
1927 North American Datum
Zone 13

NORTHERN SAN JUAN BASIN CBM EIS

FIGURE 3-14
LANDSLIDE DEPOSITS

ANALYSIS AREA: LA PLATA & ARCHULETA COUNTIES, COLORADO

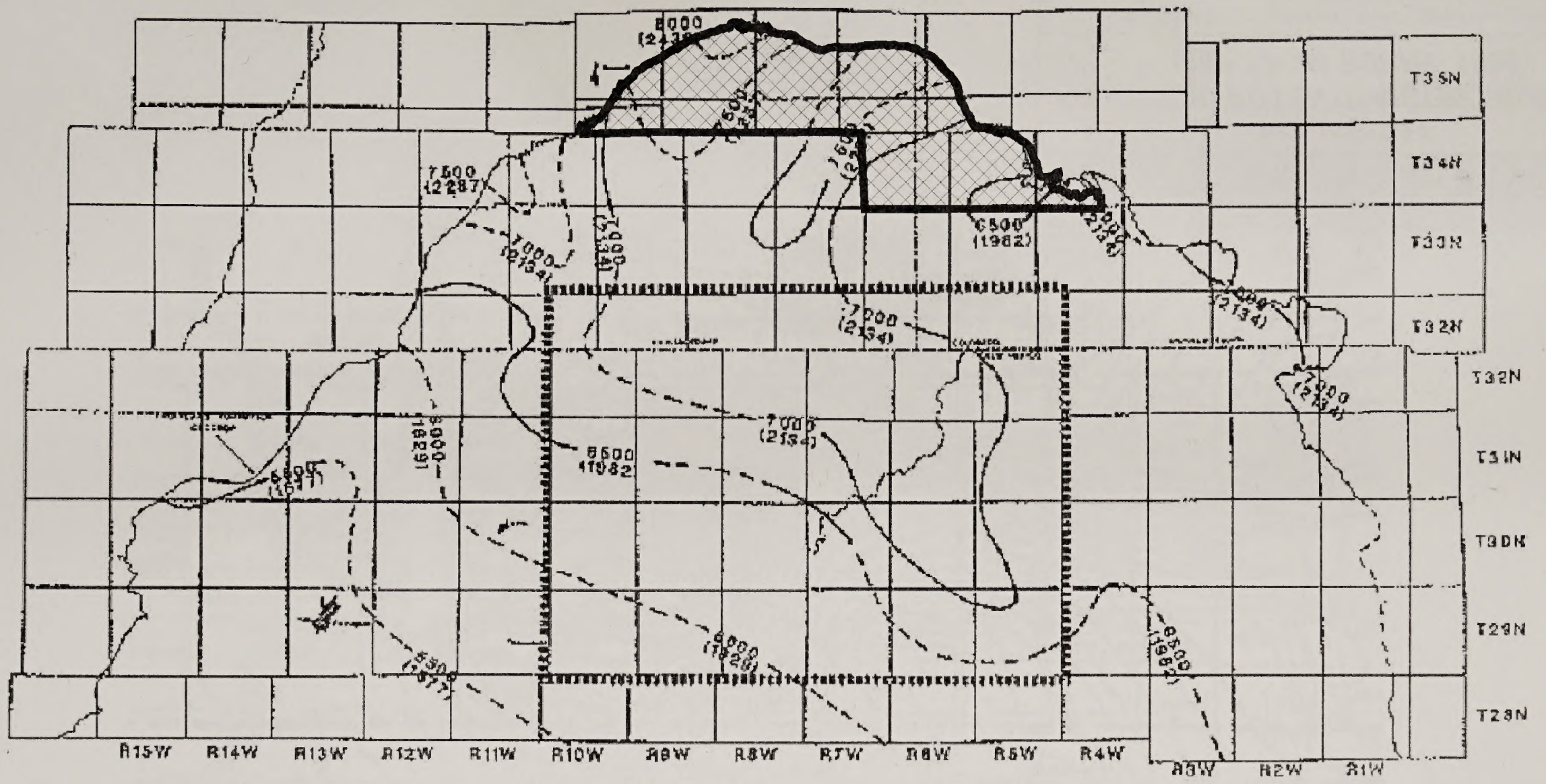
Date: 04/01/04	ArcView File: C:\1994-sanjuan\proj1.apr
	Prepared By: JG



NORTHERN SAN JUAN BASIN CBM EIS

FIGURE 3-15
DOMESTIC WELLS IN THE PROJECT AREA
(PRE-1979, POST 1979)

ANALYSIS AREA: La Plata and Archuleta Counties, CO	
Date: 04/01/04	File: I:\..\water_rights_date.mxd
Drawn By: MSH	Scale 1:150,000



LEGEND

Hydraulic Head Contours
(dashed where approximate)
Contour Interval - 500 feet

Study Area

Northern San Juan Project Boundary

Source: SJNF

N W E S

0 12 24

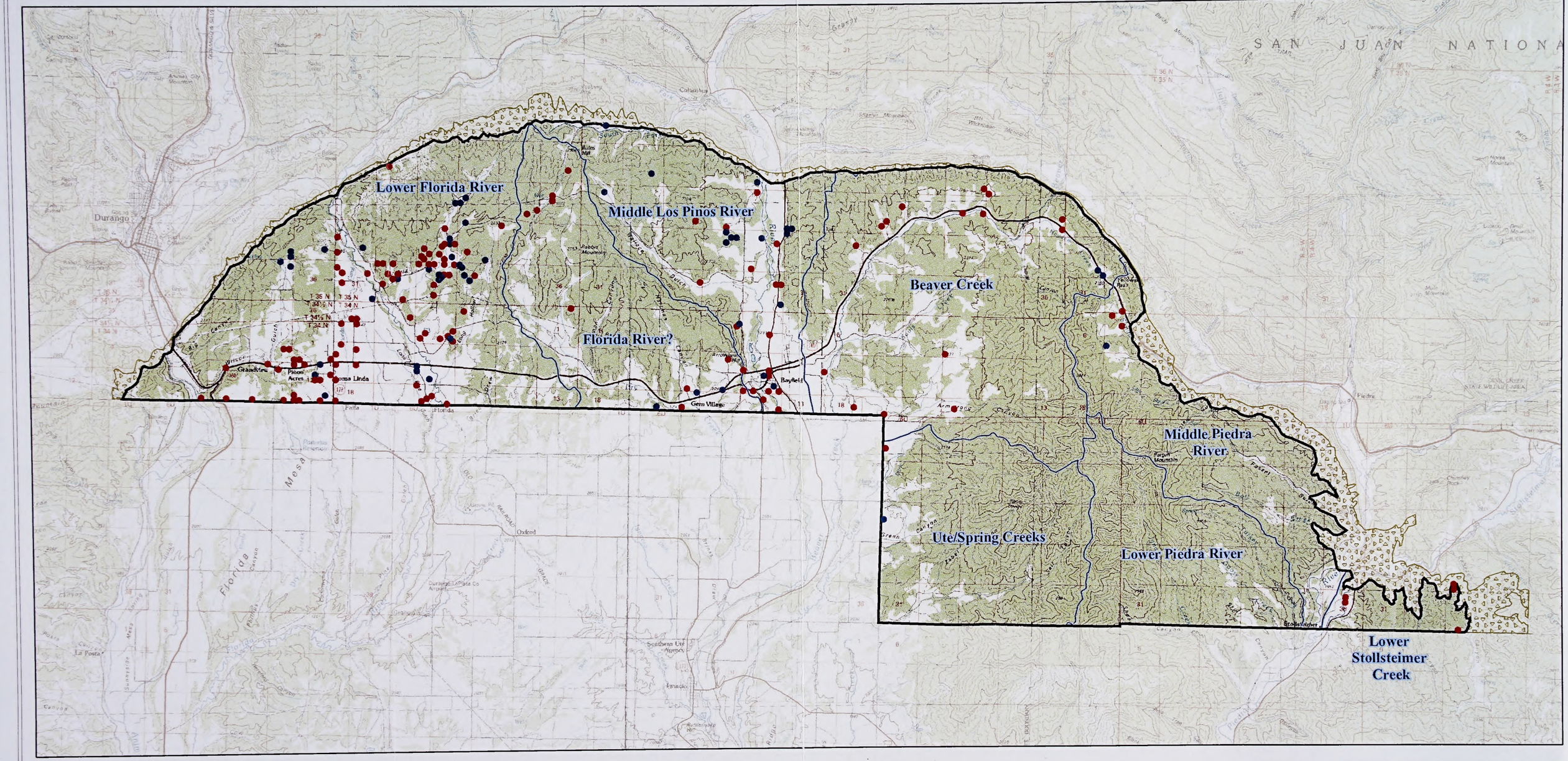
Approximate Scale in Miles

NORTHERN SAN JUAN BASIN CBM EIS

FIGURE 3-16
FRUITLAND POTENTIOMETRIC SURFACE MAP FROM McCORD, 1988

ANALYSIS AREA: LA PLATA & ARCHULETA COUNTIES, COLORADO

DATE: 04.01.04	AUTOCAD FILE: 994figs.dwg
SCALE: As Noted	PREPARED BY: ETC



Legend

- Project Area Boundary
- HUC5 Watershed Boundary
- Fruitland Formation Outcrop

Domestic Wells

- Pre-1979
- Post-1979

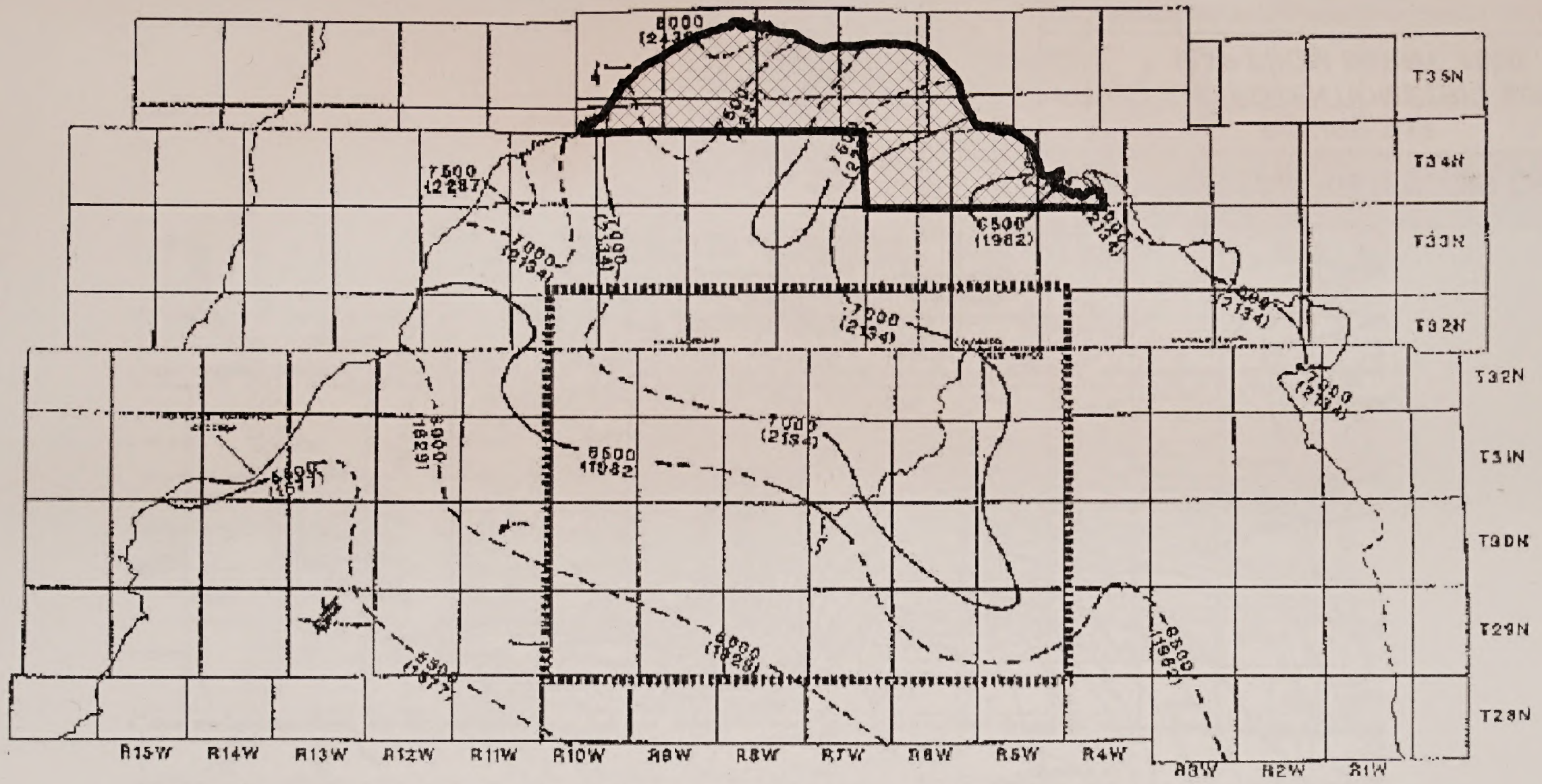
N W E S

0 1 2 4 6 8 Miles

NORTHERN SAN JUAN BASIN CBM EIS

FIGURE 3-15
DOMESTIC WELLS IN THE PROJECT AREA
(PRE-1979, POST 1979)

ANALYSIS AREA: La Plata and Archuleta Counties, CO	
Date: 04/01/04	File: I:\..\water_rights_date.mxd
Drawn By: MSH	Scale 1:150,000



LEGEND

6000 (1829)

Hydraulic Head Contours
(dashed where approximate)
Contour Interval - 500 feet

Study Area

Northern San Juan Project Boundary

N W E S

0 12 24

Approximate Scale in Miles

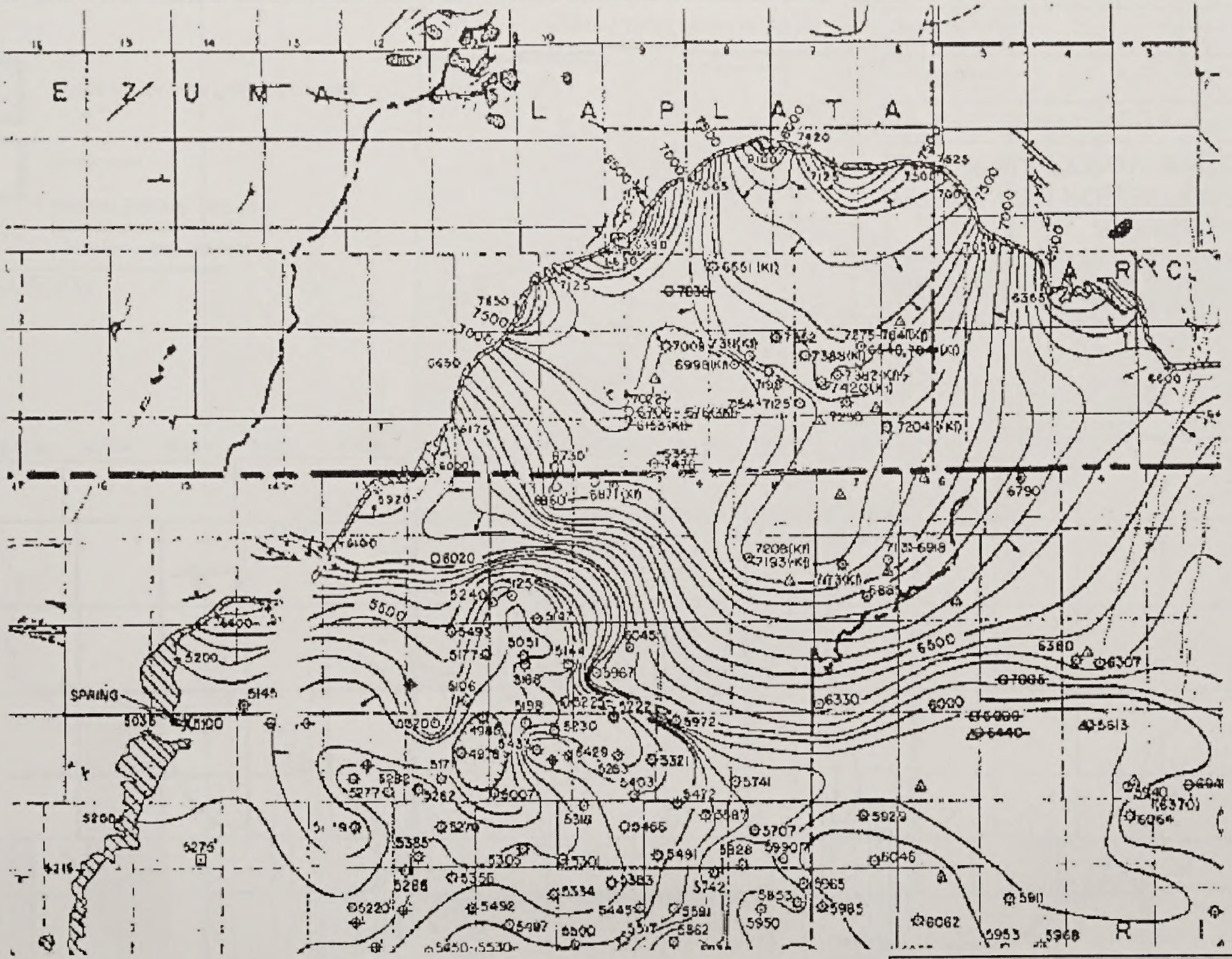
Source: SJNF

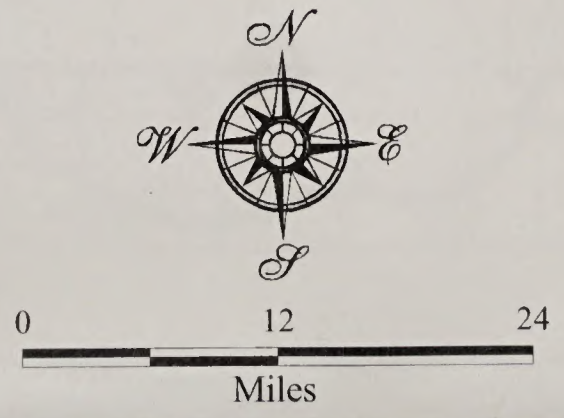
NORTHERN SAN JUAN BASIN CBM EIS

FIGURE 3-16
FRUITLAND POTENTIOMETRIC SURFACE MAP FROM McCORD, 1988

ANALYSIS AREA: LA PLATA & ARCHULETA COUNTIES, COLORADO

DATE: 04.01.04	AUTOCAD FILE: 994figs.dwg
SCALE: As Noted	PREPARED BY: ETC





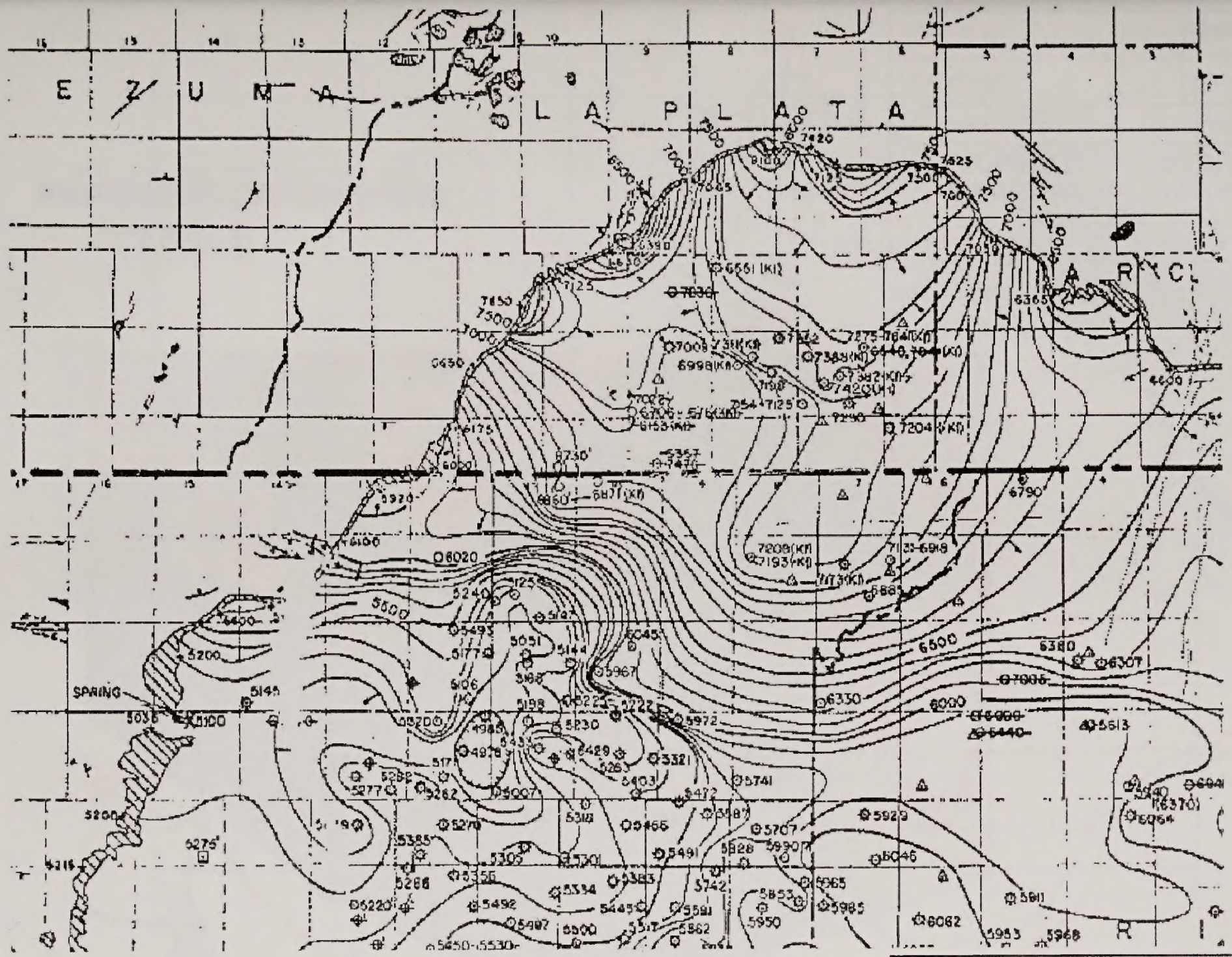
NORTHERN SAN JUAN BASIN CBM EIS

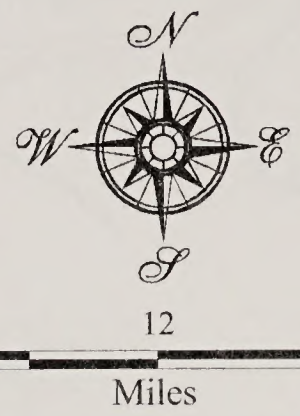
FIGURE 3-17
FRUITLAND POTENTIOMETRIC SURFACE MAP FROM BERRY, 1959

ANALYSIS AREA: LA PLATA & ARCHULETA COUNTIES, COLORADO

DATE: 04.01.04	AUTOCAD FILE: 994figs.dwg
SCALE: As Noted	PREPARED BY: ETC

Source: SJNF





0 12 24

Miles

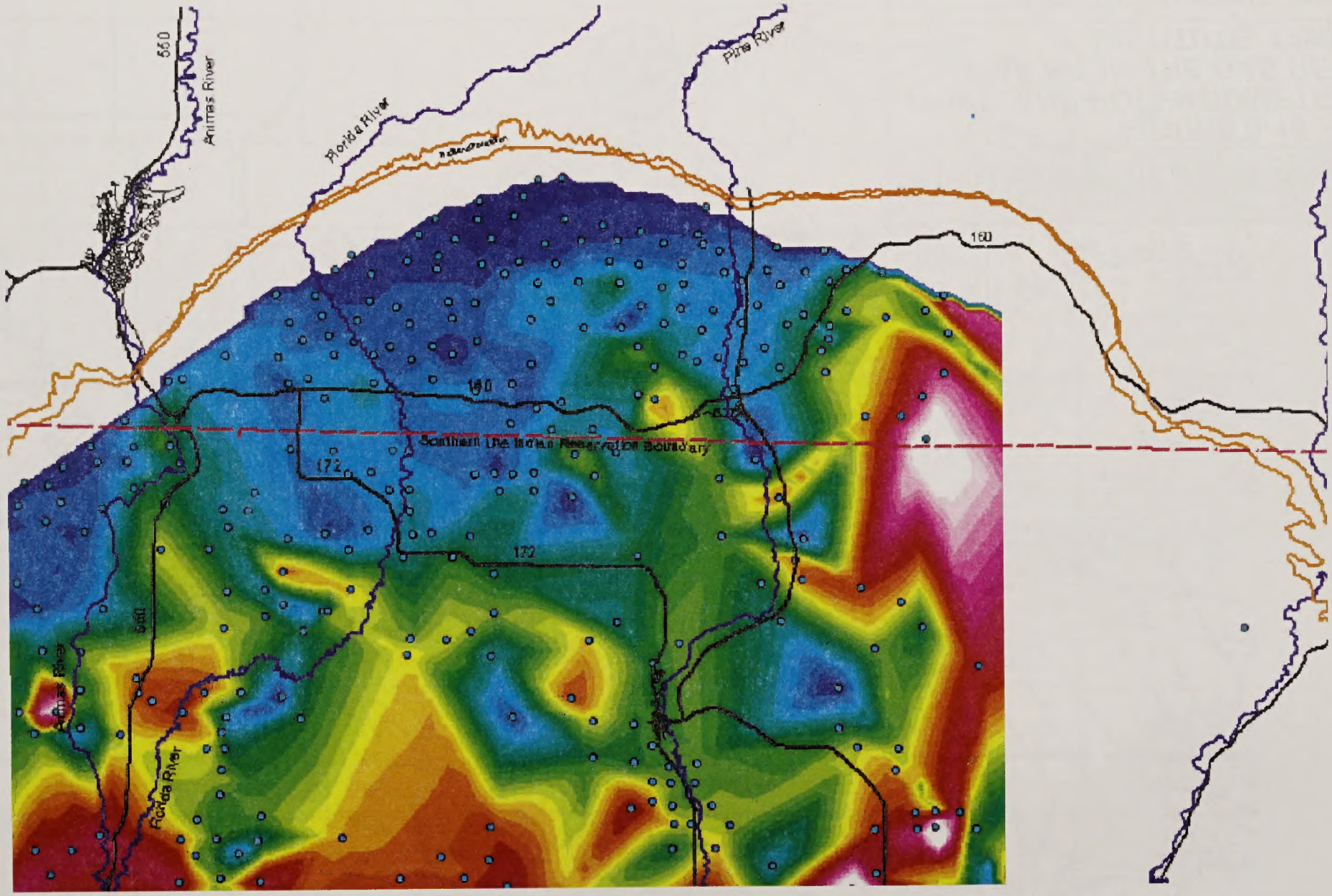
NORTHERN SAN JUAN BASIN CBM EIS

FIGURE 3-18 FRUITLAND POTENTIOMETRIC SURFACE MAP FROM THE GAS RESEARCH INSTITUTE, 1990

ANALYSIS AREA: LA PLATA & ARCHULETA COUNTIES, COLORADO

DATE: 04.01.04	AUTOCAD FILE: 994figs.dwg
SCALE: As Noted	PREPARED BY: ETC

Source: SJNF



LEGEND

TDS (mg/l) 250 2250 4250 6250 8250 10250 12250 14250

N W E S

NORTHERN SAN JUAN BASIN CBM EIS	
FIGURE 3-19 CONTOUR PLOT OF TDS CONCENTRATIONS IN FRUITLAND FORMATION PRODUCED WATER	
ANALYSIS AREA: LA PLATA & ARCHULETA COUNTIES, COLORADO	
DATE: 04.01.04	AUTOCAD FILE: 994figs.dwg
SCALE: nts	PREPARED BY: ETC

Source: SJNF

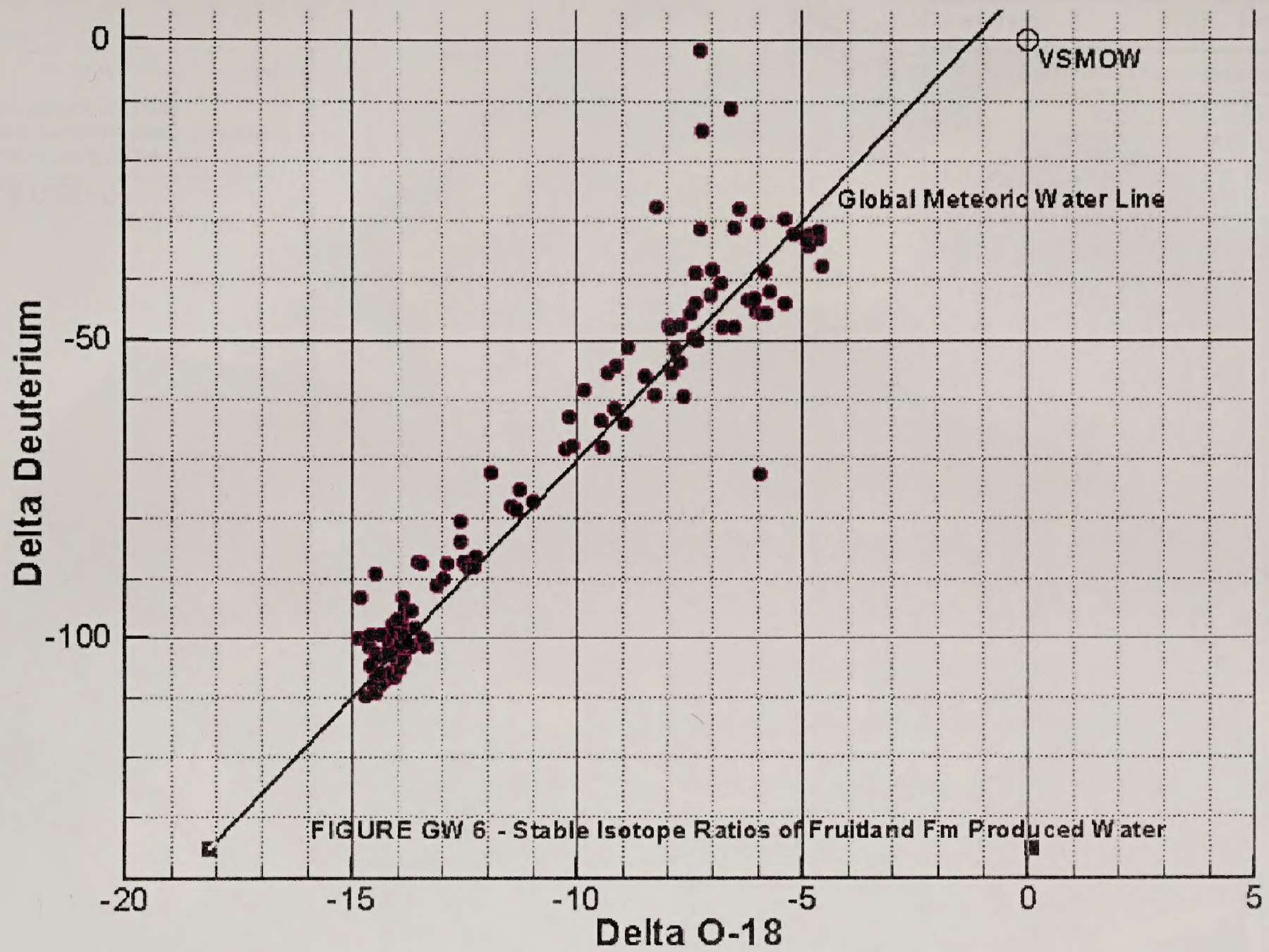
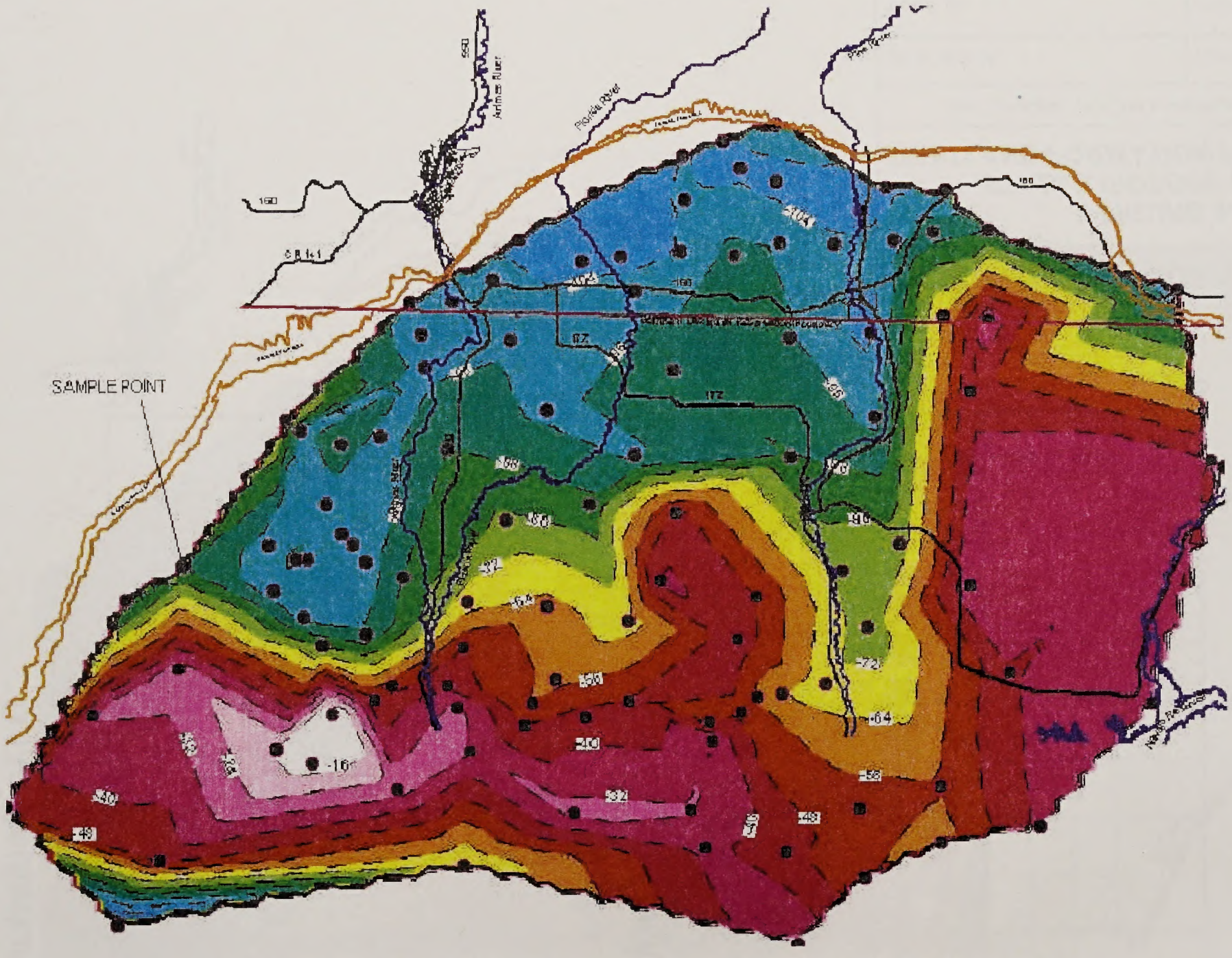


FIGURE GW 6 - Stable Isotope Ratios of Fruitland Fm Produced Water

Source: SJNF

NORTHERN SAN JUAN BASIN CBM EIS	
FIGURE 3-20 *STABLE ISOTOPE RATIOS OF* *FRUITLAND FORMATION PRODUCED WATER*	
ANALYSIS AREA: LA PLATA & ARCHULETA COUNTIES, COLORADO	
DATE: 04.01.04	AUTOCAD FILE: 994figs.dwg
SCALE: nts	PREPARED BY: ETC

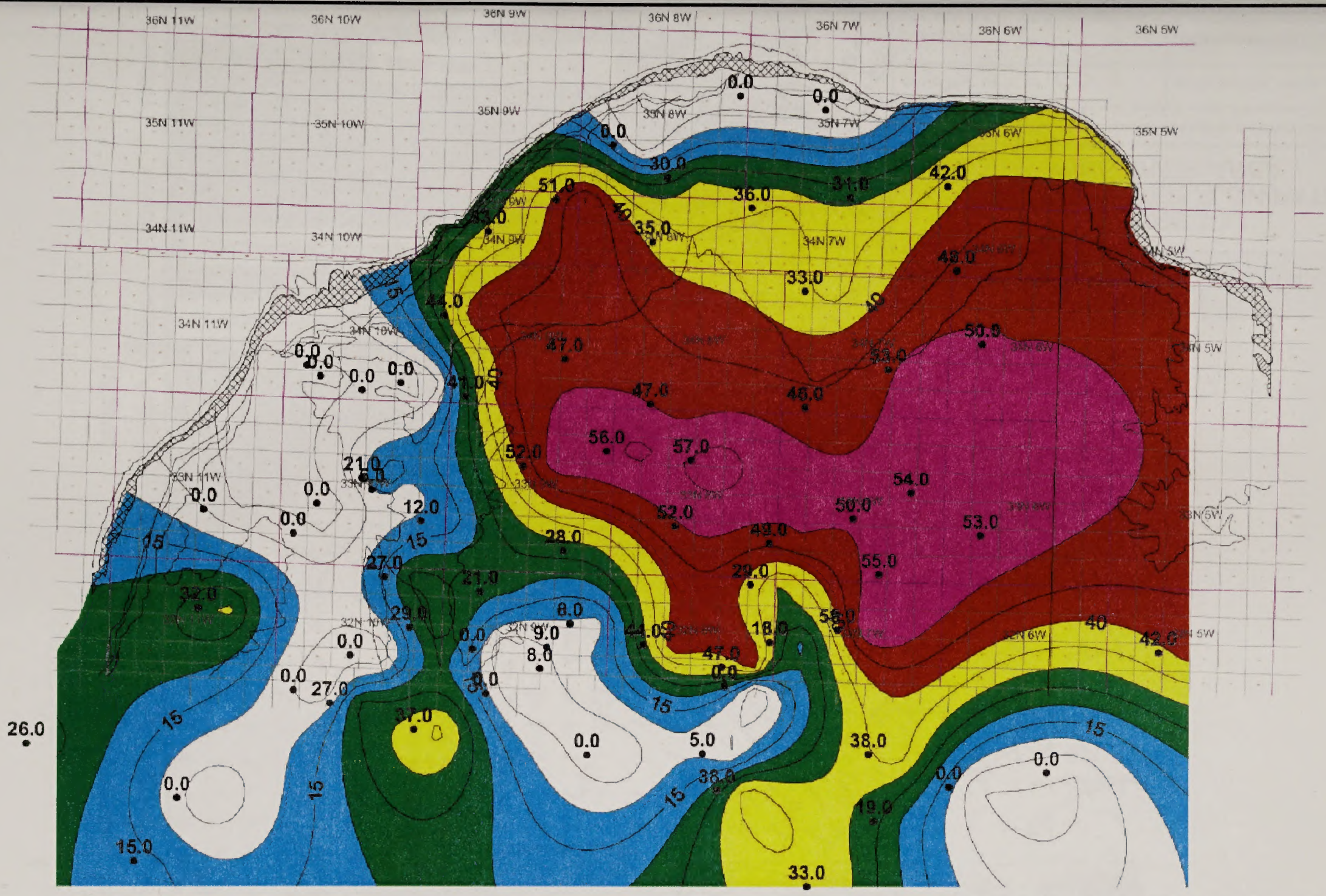


LEGEND

Contour of Delta Deuterium
Values in Produced Water Samples
Contour Interval = 8 units

NORTHERN SAN JUAN BASIN CBM EIS	
FIGURE 3-21 CONTOUR PLOT OF DELTA DEUTERIUM IN FRUITLAND FORMATION PRODUCED WATER	
ANALYSIS AREA: LA PLATA & ARCHULETA COUNTIES, COLORADO	
DATE: 04.01.04	AUTOCAD FILE: 994figs.dwg
SCALE: nts	PREPARED BY: ETC

Source: SJNF



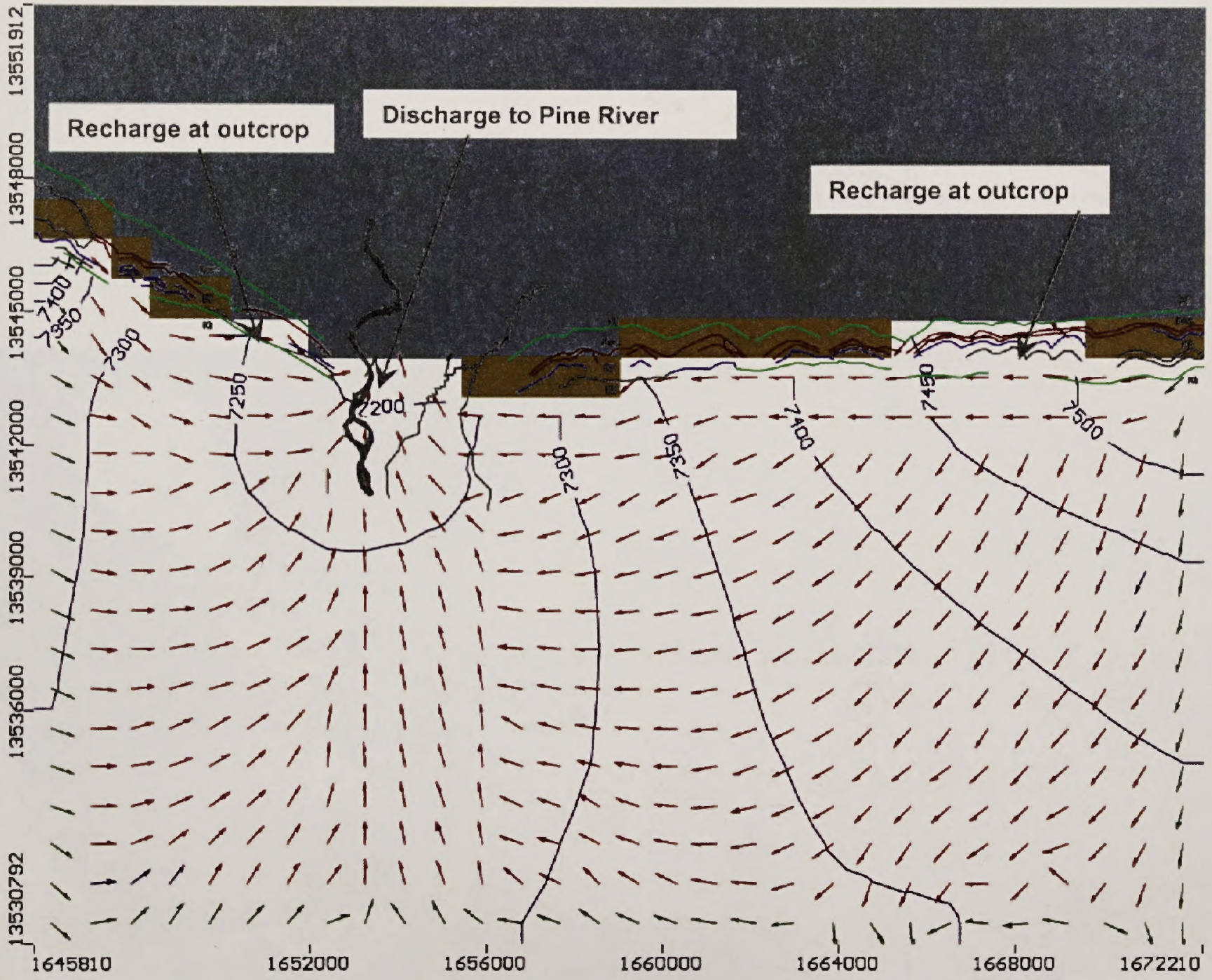


0 6 12

Miles

Source: SJNF

NORTHERN SAN JUAN BASIN CBM EIS	
FIGURE 3-22 IODINE AGE MAP	
ANALYSIS AREA: LA PLATA & ARCHULETA COUNTIES, COLORADO	
DATE: 04.01.04	AUTOCAD FILE: 994figs.dwg
SCALE: As Noted	PREPARED BY: ETC



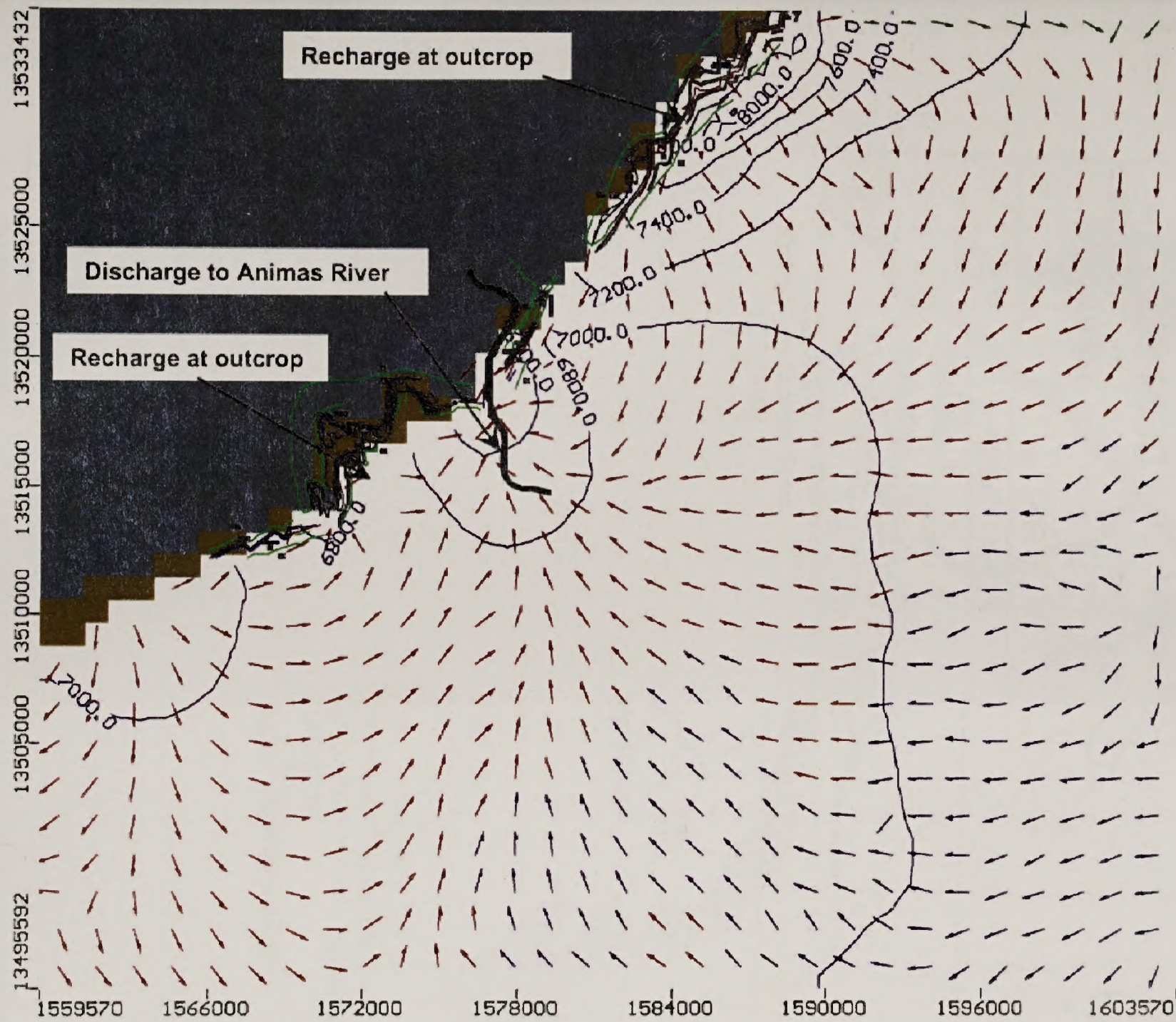
NORTHERN SAN JUAN BASIN CBM EIS

FIGURE 3-23
GROUND WATER FLOWPATHS: PINE RIVER AREA

ANALYSIS AREA: LA PLATA & ARCHULETA COUNTIES, COLORADO

DATE: 04.01.04	AUTOCAD FILE: 994figs.dwg
SCALE: nts	PREPARED BY: ETC

Source: SJNF





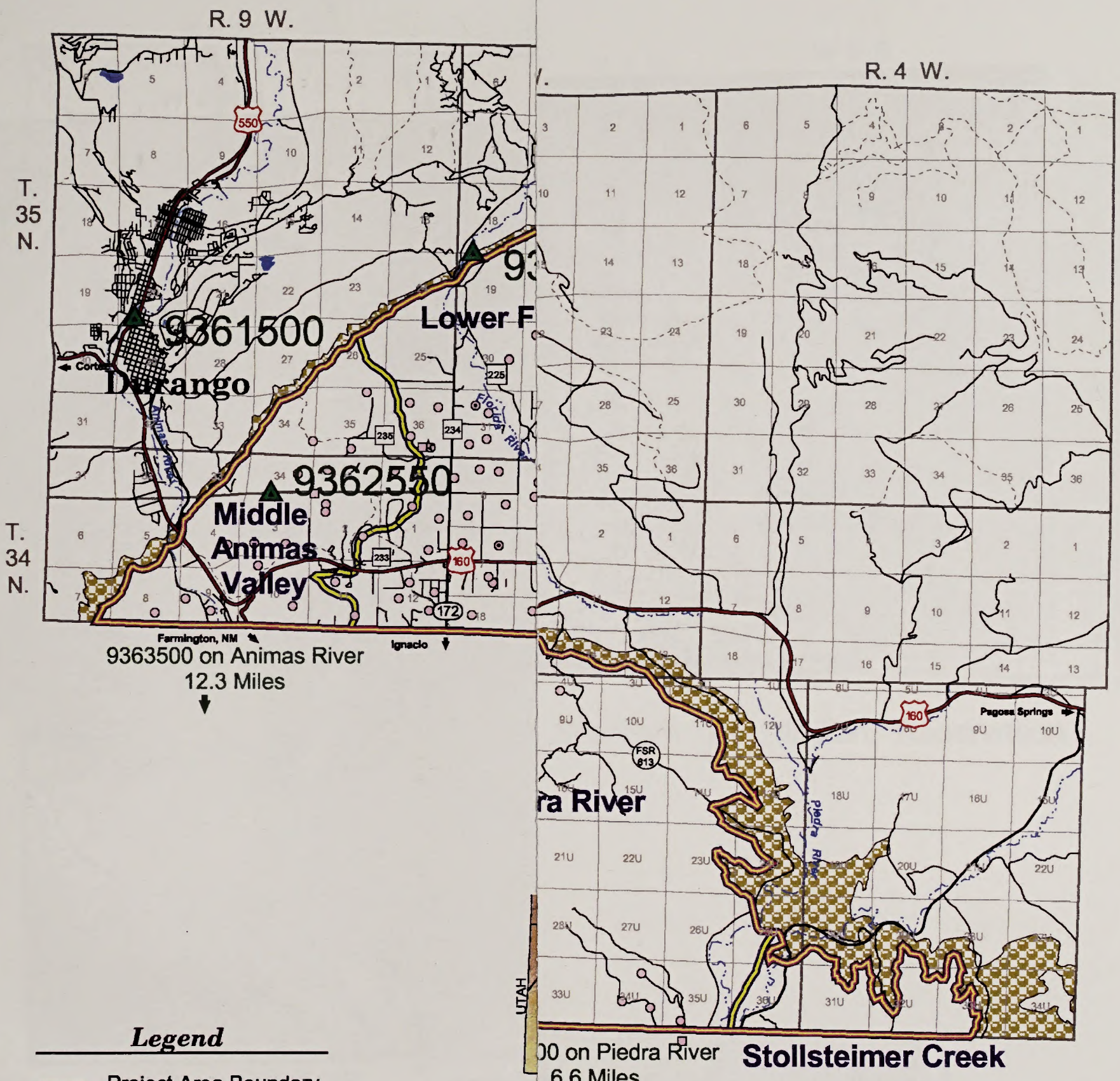
NORTHERN SAN JUAN BASIN CBM EIS

FIGURE 3-24
GROUND WATER FLOWPATHS:
ANIMAS RIVER AREA

ANALYSIS AREA: LA PLATA & ARCHULETA COUNTIES, COLORADO

DATE: 04.01.04	AUTOCAD FILE: 994figs.dwg
SCALE: nts	PREPARED BY: ETC

Source: SJNF



Legend

- Project Area Boundary
- Existing Compressor
- Existing Non-Fruitland Well
- Existing Fruitland Well
- Existing Disposal Well
- USGS Gaging Station
- County Line
- U.S. Highway
- Primary Road
- Secondary Road
- Lake/Reservoir
- Stream/River
- Watershed Boundary (HUC 5)
- Fruitland Formation Outcrop

ovided
udy, 1998.
portation

JSGS.

NORTHERN SAN JUAN BASIN CBM EIS	
FIGURE 3-25 ***USGS WATER MONITORING STATIONS***	
ANALYSIS AREA: LA PLATA & ARCHULETA COUNTIES, COLORADO	
Date: 04/01/04	ArcView File: C:\994-sanjuan\proj1.apr
	Prepared By: JG

R. 9 W. R. 8 W. R. 7 W. R. 6 W. R. 5 W. R. 4 W.

T. 35 N.

T. 34 N.

9361500
Durango

9363050
Lower Florida River

9362550
Middle Animas Valley

Middle Los Pinos River

Lower Los Pinos River

Beaver Creek

Bayfield

Gem Valley

Ignacio

Farmington, NM

9363500 on Animas River
12.3 Miles

Southern Ute Indian Reservation

9353800 on Los Pinos River
14.2 Miles

T. 34 N.

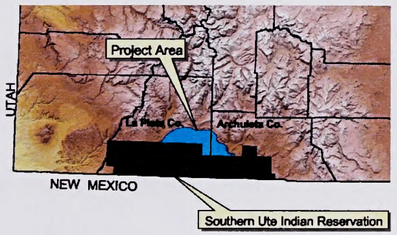
Lower Los Pinos River

Lower Piedra River

Stollsteimer Creek

9349800 on Piedra River
6.6 Miles

Southern Ute Indian Reservation



Legend

- Project Area Boundary
- Existing Compressor
- Existing Non-Fruitland Well
- Existing Fruitland Well
- Existing Disposal Well
- USGS Gaging Station
- County Line
- U.S. Highway
- Primary Road
- Secondary Road
- Lake/Reservoir
- Stream/River
- Watershed Boundary (HUC 5)
- Fruitland Formation Outcrop

2 0 2 4 6 8 *Kilometers*

2 0 2 4 6 8 *Miles*

La Plata County transportation data provided by the La Plata County Transportation Study, 1998. Hydrologic and Archuleta County transportation features extracted from 1:100,000 USGS SDTS data.
Gaging station data provided by the USGS.

Transverse Mercator Projection
1927 North American Datum
Zone 13

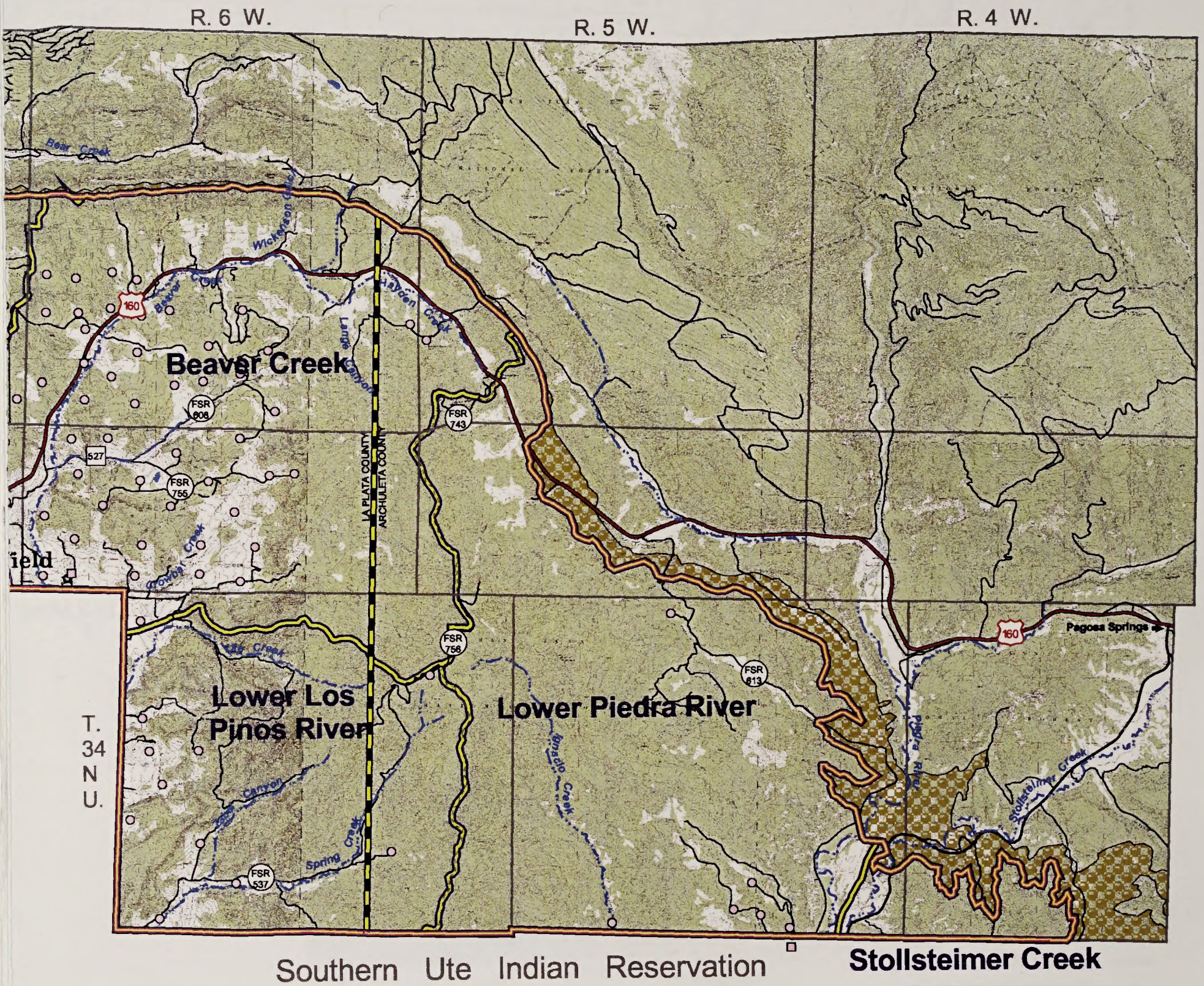
NORTHERN SAN JUAN BASIN CBM EIS

FIGURE 3-25
USGS WATER MONITORING STATIONS

ANALYSIS AREA: LA PLATA & ARCHULETA COUNTIES, COLORADO

Date: 04/01/04 | ArcView File: C:\994-sanjuan\proj1.apr

Prepared By: JG



La Plata County transportation data provided by the La Plata County Transportation Study, 1998. Hydrologic and Archuleta County transportation features extracted from 1:100,000 USGS SDTS data. Watershed data provided by the USFS.

8 Kilometers

6 8 Miles

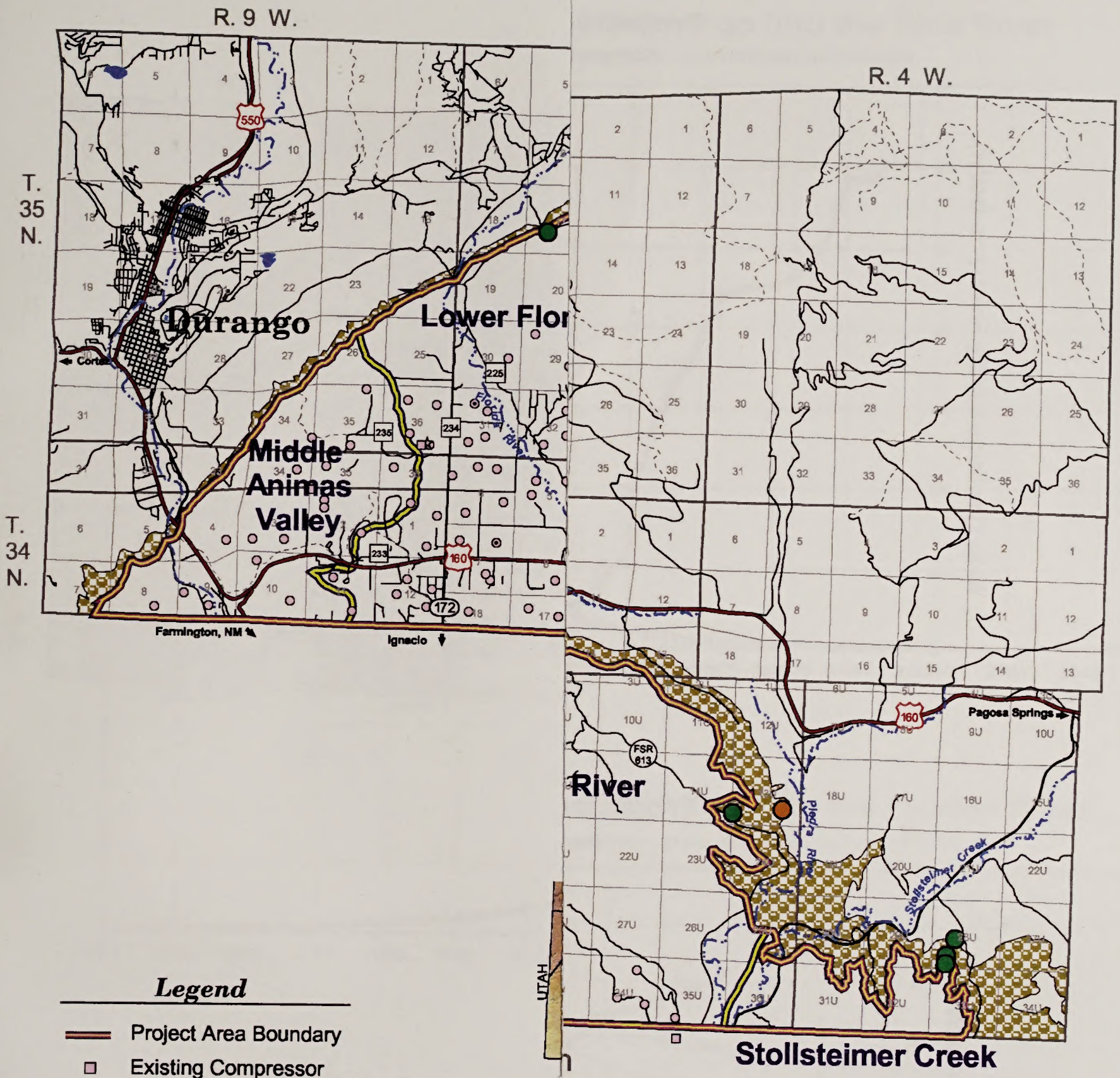
Transverse Mercator Projection
1927 North American Datum
Zone 13

NORTHERN SAN JUAN BASIN CBM EIS

FIGURE 3-26
WATERSHEDS

ANALYSIS AREA: LA PLATA & ARCHULETA COUNTIES, COLORADO

Date: 04/01/04	ArcView File: C:\994-sanjuan\proj1.apr
	Prepared By: JG



Legend

- Project Area Boundary
- Existing Compressor
- Existing Non-Fruitland Well
- Existing Fruitland Well
- Existing Disposal Well
- Seep/Spring
- Wet Land Due to Spring
- County Line
- U.S. Highway
- Primary Road
- Secondary Road
- Lake/Reservoir
- Stream/River
- Watershed Boundary (HUC 5)
- Fruitland Formation Outcrop

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udy, 1998.
portation

NORTHERN SAN JUAN BASIN CBM EIS

FIGURE 3-27
SEEPS & SPRINGS
ALONG THE OUTCROP

ANALYSIS AREA: LA PLATA & ARCHULETA COUNTIES, COLORADO

Date: 04/01/04	ArcView File: C:\994-sanjuan\proj1.apr
	Prepared By: JG

R. 9 W. R. 8 W. R. 7 W. R. 6 W. R. 5 W. R. 4 W.

T. 35 N.

T. 34 N.

Durango

Lower Florida River

Middle Los Pinos River

Middle Animas Valley

Lower Los Pinos River

Beaver Creek

Bayfield

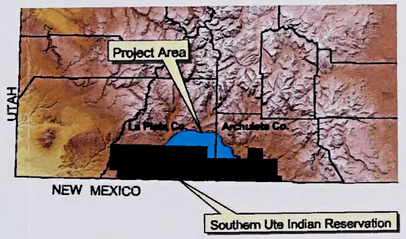
Lower Los Pinos River

Lower Piedra River

Stollsteimer Creek

Southern Ute Indian Reservation

Southern Ute Indian Reservation



Legend

- Existing Disposal Well
- Existing Fruitland Well
- Existing Non-Fruitland Well
- Existing Compressor
- U.S. Highway
- Primary Road
- Secondary Road
- Project Area Boundary
- County Line
- Fruitland Formation Outcrop
- Watershed Boundary (HUC 5)

2 0 2 4 6 8 *Kilometers*

2 0 2 4 6 8 *Miles*

La Plata County transportation data provided by the La Plata County Transportation Study, 1998. Hydrologic and Archuleta County transportation features extracted from 1:100,000 USGS SDTS data. Watershed data provided by the USFS.

Transverse Mercator Projection
1927 North American Datum
Zone 13

NORTHERN SAN JUAN BASIN CBM EIS

FIGURE 3-26
WATERSHEDS

ANALYSIS AREA: LA PLATA & ARCHULETA COUNTIES, COLORADO	
Date: 04/01/04	ArcView File: C:\994-sanjuan\proj1.apr
	Prepared By: JG

R. 9 W. R. 8 W. R. 7 W. R. 6 W. R. 5 W. R. 4 W.

T. 35 N.

T. 34 N.

T. 34 N. U.

Durango

Lower Florida River

Middle Los Pinos River

Middle Animas Valley

Lower Los Pinos River

Beaver Creek

Bayfield

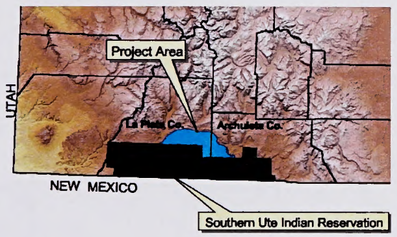
Southern Ute Indian Reservation

Lower Los Pinos River

Lower Piedra River

Stollsteimer Creek

Southern Ute Indian Reservation



Legend

- Project Area Boundary
- Existing Compressor
- Existing Non-Fruitland Well
- Existing Fruitland Well
- Existing Disposal Well
- Seep/Spring
- Wet Land Due to Spring
- County Line
- U.S. Highway
- Primary Road
- Secondary Road
- Lake/Reservoir
- Stream/River
- Watershed Boundary (HUC 5)
- Fruitland Formation Outcrop

2 0 2 4 6 8 *Kilometers*

2 0 2 4 6 8 *Miles*

La Plata County transportation data provided by the La Plata County Transportation Study, 1998. Hydrologic and Archuleta County transportation features extracted from 1:100,000 USGS SDTS data.

Transverse Mercator Projection
1927 North American Datum
Zone 13

NORTHERN SAN JUAN BASIN CBM EIS

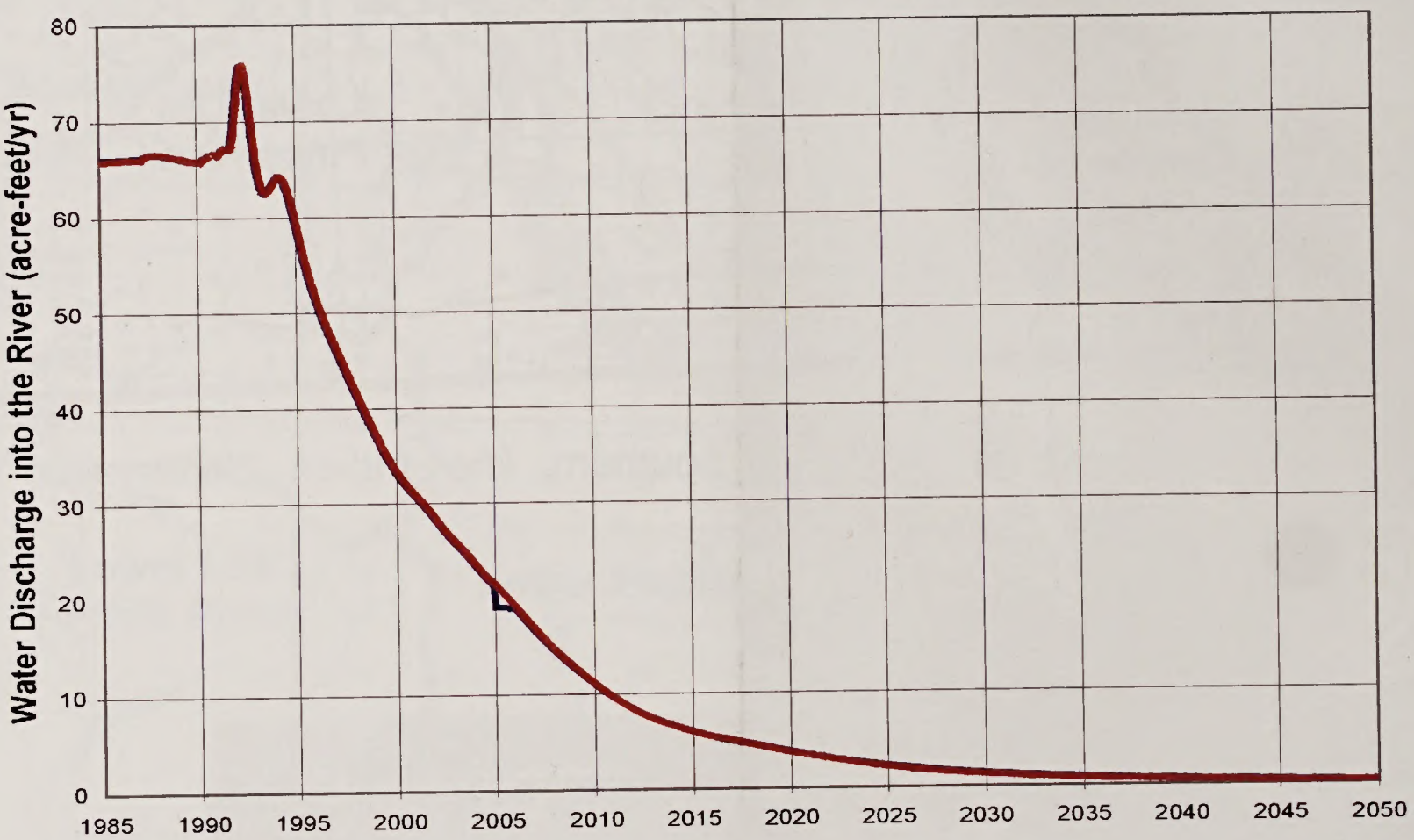
FIGURE 3-27
SEEPS & SPRINGS ALONG THE OUTCROP

ANALYSIS AREA: LA PLATA & ARCHULETA COUNTIES, COLORADO

Date: 04/01/04	ArcView File: C:\994-sanjuan\proj1.apr
	Prepared By: JG

Projected Discharge into the Animas River

Comparison With and Without Infill Wells

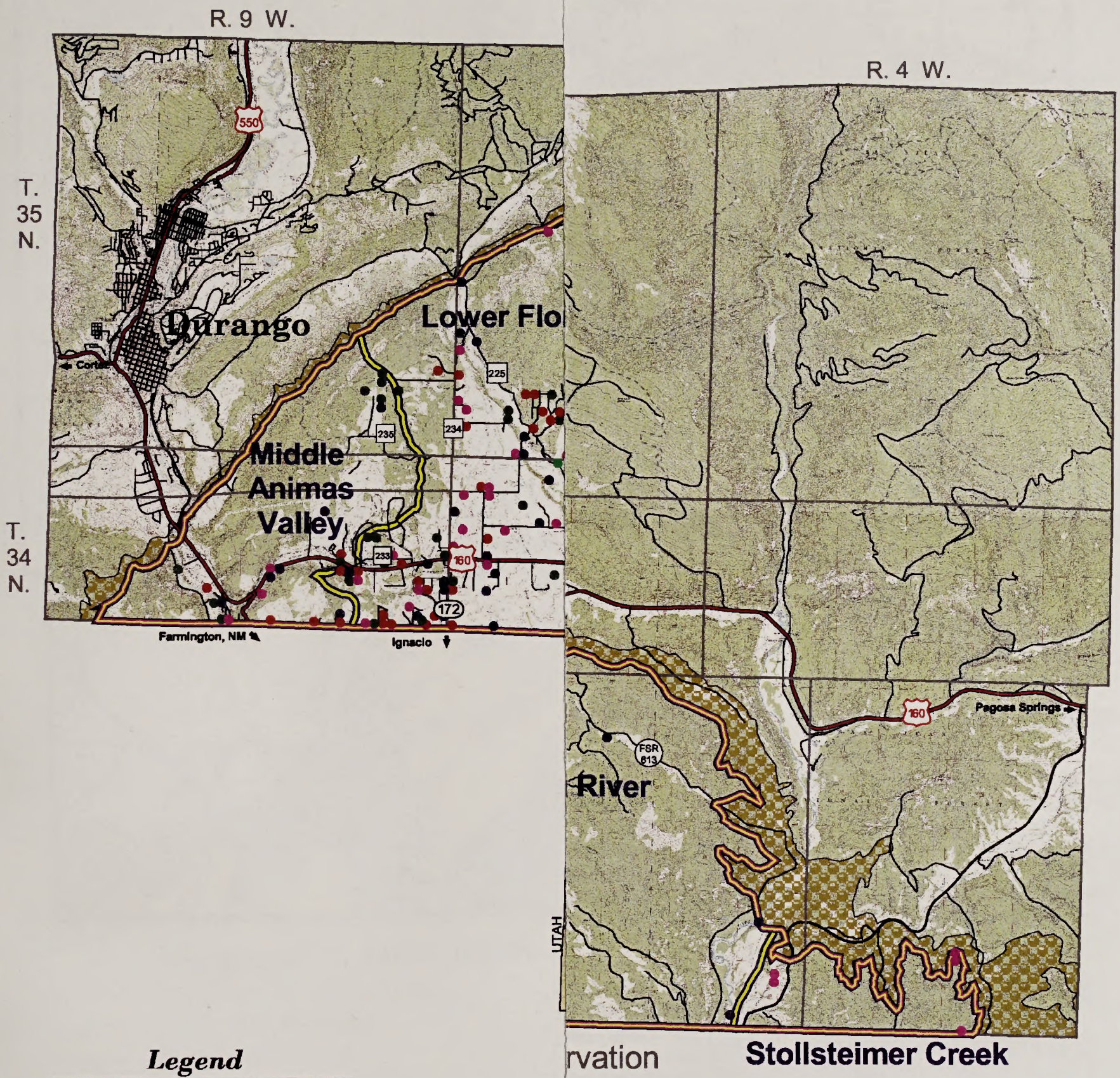


Legend

- Without Infill Wells
- With Infill Wells

NORTHERN SAN JUAN BASIN CBM EIS	
FIGURE 3-28 PROJECTED DEPLETIONS IN SURFACE FLOWS	
ANALYSIS AREA: LA PLATA & ARCHULETA COUNTIES, COLORADO	
Date: 09/09/03	ArcView File: C:\994-sanjuan\proj1.apr
	Prepared By: JG

Source: Cox et al, 2001.



Legend

Use Category
- Domestic
- Irrigation
- Multiple Use
- Other
- Stock

Project Area Boundary

Fruitland Formation Outcrop

Watershed Boundary (HUC 5)

NORTHERN SAN JUAN BASIN CBM EIS

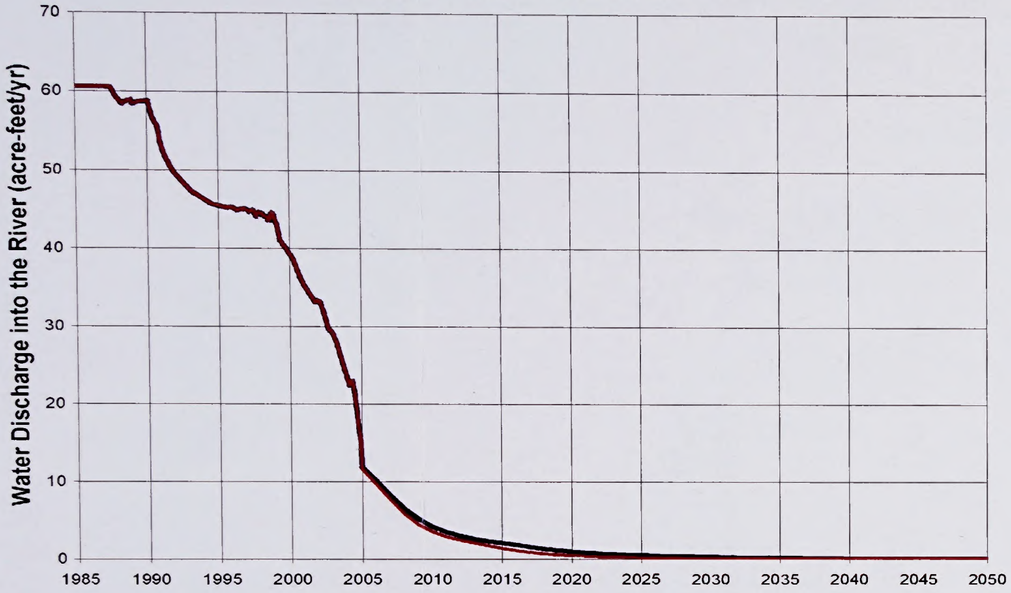
FIGURE 3-29
SURFACE WATER RIGHTS FILED WITH COLORADO DIVISION 7

ANALYSIS AREA: LA PLATA & ARCHULETA COUNTIES, COLORADO

Date: 04/01/04	ArcView File: C:\994-sanjuan\proj1.apr
	Prepared By: JG

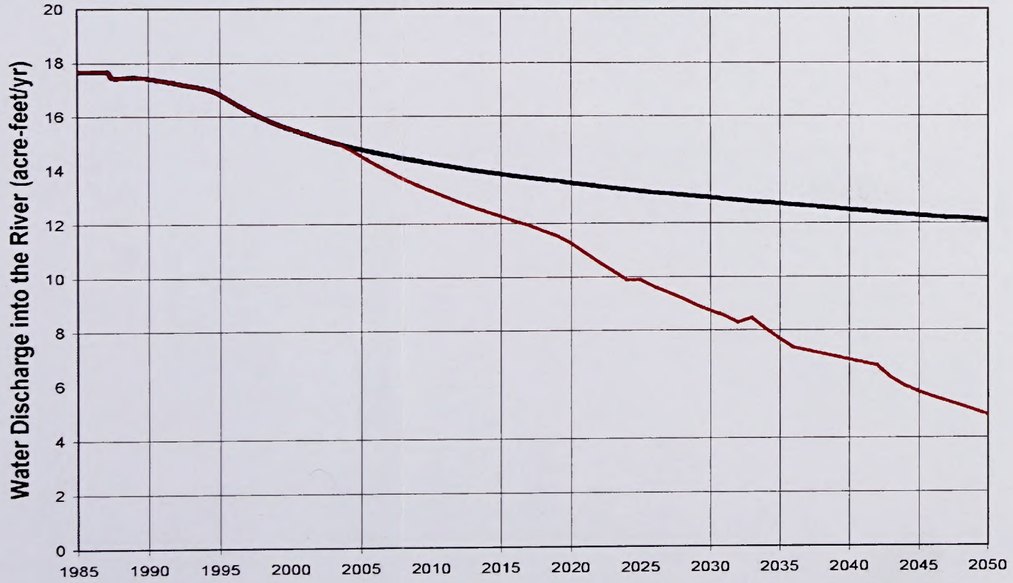
Projected Discharge into the Pine River

Comparison With and Without Infill Wells



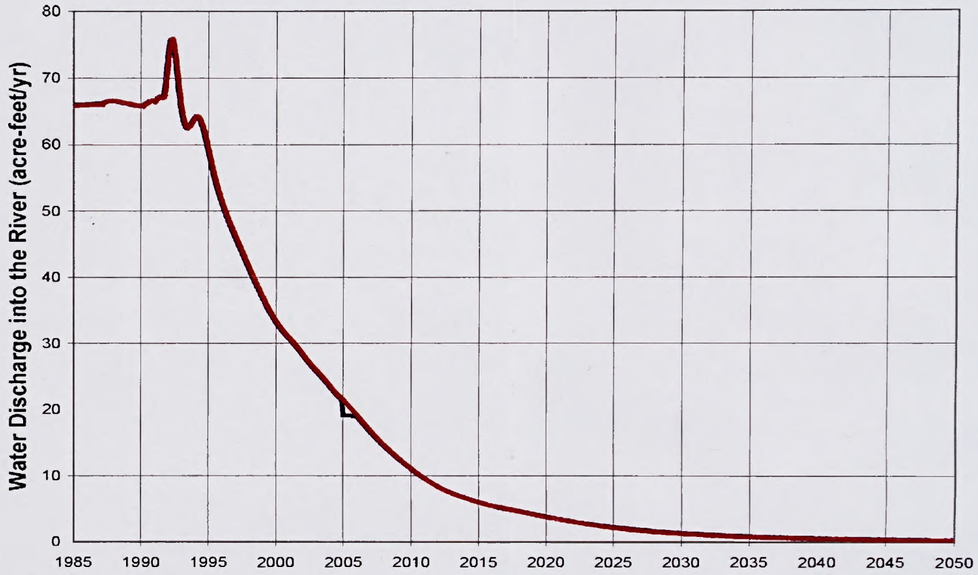
Projected Discharge into the Florida River

Comparison With and Without Infill Wells



Projected Discharge into the Animas River

Comparison With and Without Infill Wells



Legend

- Without Infill Wells
- With Infill Wells

Source: Cox et al, 2001.

NORTHERN SAN JUAN BASIN CBM EIS	
FIGURE 3-28 PROJECTED DEPLETIONS IN SURFACE FLOWS	
ANALYSIS AREA: LA PLATA & ARCHULETA COUNTIES, COLORADO	
Date: 09/09/03	ArcView File: C:\994-sanjuan\proj1.apr
	Prepared By: JG

R. 9 W. R. 8 W. R. 7 W. R. 6 W. R. 5 W. R. 4 W.

T. 35 N.

T. 34 N.

Durango

Lower Florida River

Middle Animas Valley

Middle Los Pinos River

Lower Los Pinos River

Beaver Creek

Gem Valley

Bayfield

Farmington, NM

Ignacio

Southern Ute Indian Reservation

T. 34 N. U.

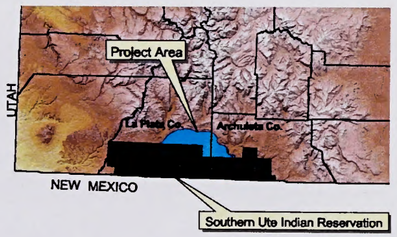
Lower Los Pinos River

Lower Piedra River

Pagosa Springs

Southern Ute Indian Reservation

Stollsteimer Creek



Legend

Use Category
- Domestic
- Irrigation
- Multiple Use
- Other
- Stock

Project Area Boundary

Fruitland Formation Outcrop

Watershed Boundary (HUC 5)

N W E S

2 0 2 4 6 8 *Kilometers*

2 0 2 4 6 8 *Miles*

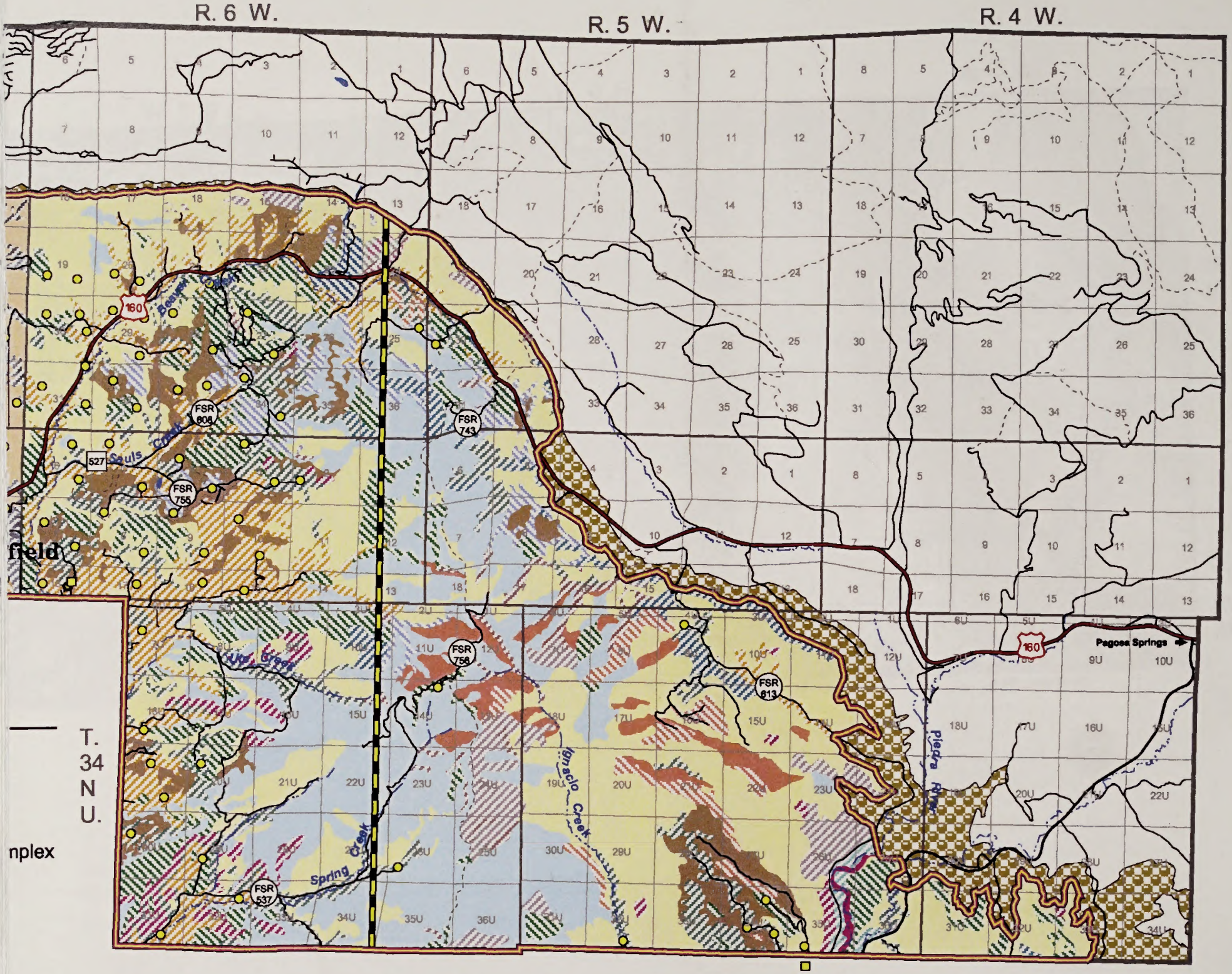
Transverse Mercator Projection
1927 North American Datum
Zone 13

NORTHERN SAN JUAN BASIN CBM EIS

FIGURE 3-29
SURFACE WATER RIGHTS FILED WITH COLORADO DIVISION 7

ANALYSIS AREA: LA PLATA & ARCHULETA COUNTIES, COLORADO

Date: 04/01/04	ArcView File: C:\994-sanjuan\proj1.apr
	Prepared By: JG



La Plata County transportation data provided by the La Plata County Transportation Study, 1998. Hydrologic and Archuleta County transportation features extracted from 1:100,000 USGS SDTS data.
Existing wells extracted from COGCC well database and edited by BLM & USFS.
Soils types digitized from the La Plata & Piedra soil surveys.

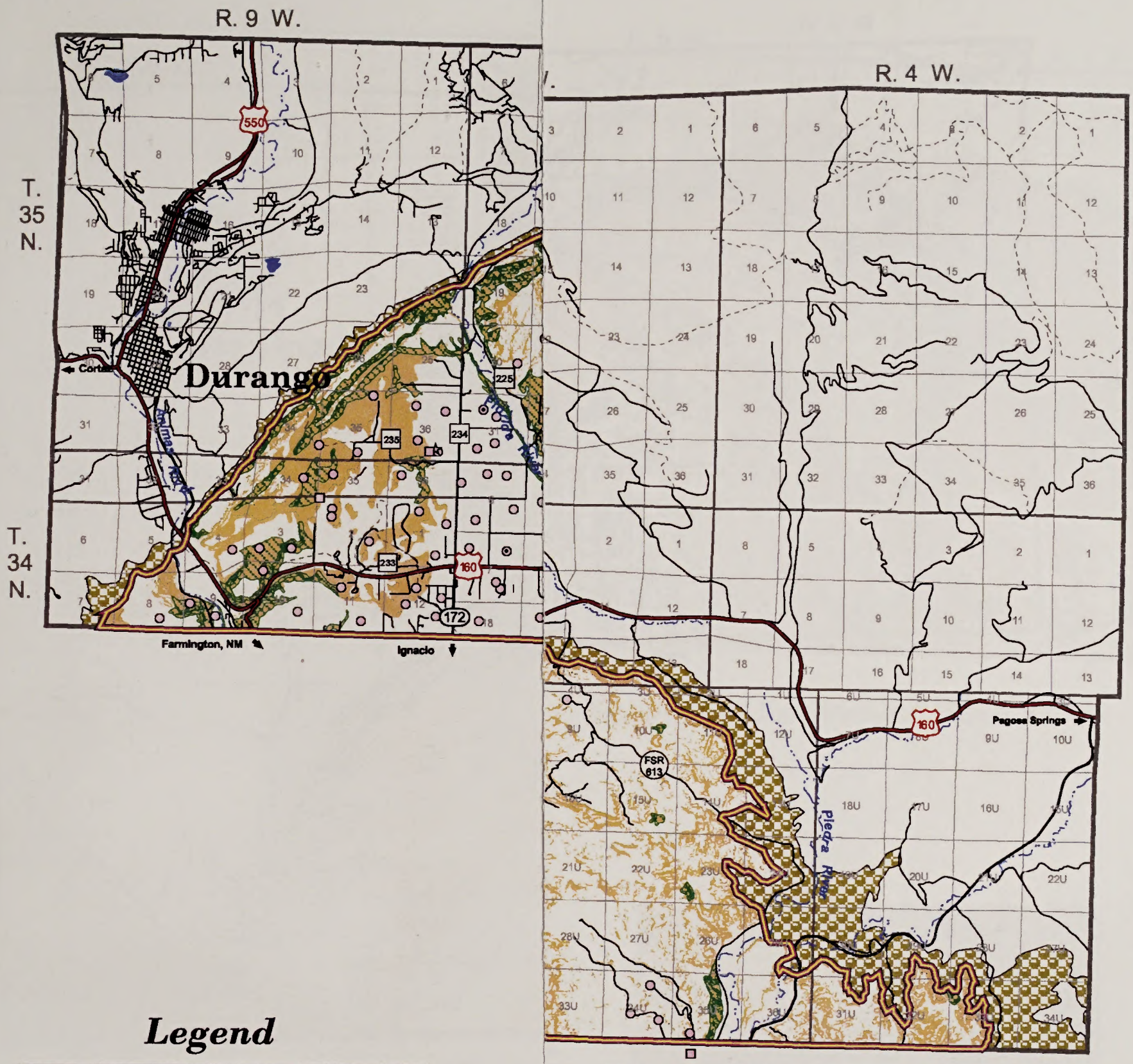
Transverse Mercator Projection
1927 North American Datum
Zone 13

NORTHERN SAN JUAN BASIN CBM EIS

FIGURE 3-30
DISTRIBUTION OF SOIL MAP UNITS ACROSS THE PROJECT AREA

ANALYSIS AREA: LA PLATA & ARCHULETA COUNTIES, COLORADO

Date: 04/01/04	ArcView File: C:\994-sanjuan\proj1.apr
	Prepared By: JG



an Reservation

Legend

- Project Area Boundary
- Existing Compressor
- Existing Non-Fruitland Well
- Existing Fruitland Well
- Existing Disposal Well
- County Line
- U.S. Highway
- Primary Road
- Secondary Road
- Trail
- Lake/Reservoir
- Stream/River
- Fruitland Formation Outcrop
- High Potential for Wind Erosion
- High Potential for Water Erosion

ovided
udy, 1998.
ortation

database

NORTHERN SAN JUAN BASIN CBM EIS

FIGURE 3-31
AREAS OF HIGH POTENTIAL FOR WIND & WATER EROSION

ANALYSIS AREA: LA PLATA & ARCHULETA COUNTIES, COLORADO

Date: 04/01/04	ArcView File: C:\994-sanjusn\proj1.apr
	Prepared By: JG

R. 9 W. R. 8 W. R. 7 W. R. 6 W. R. 5 W. R. 4 W.

T. 35 N.

T. 34 N.

T. 34 N. U.

Durango

Bayfield

Ignacio

Farmington, NM

Pagosa Springs

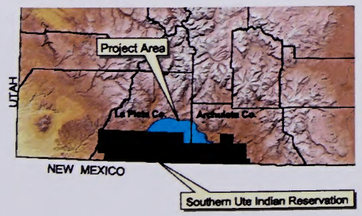
Southern Ute Indian Reservation

Southern Ute Indian Reservation

Legend

- Project Area Boundary
- Existing Compressor
- Existing Non-Fruitland Well
- Existing Fruitland Well
- Existing Disposal Well
- County Line
- U.S. Highway
- Primary Road
- Secondary Road
- Trail
- Lake/Reservoir
- Stream/River
- Fruitland Formation Outcrop

- 10- Bayfield Silty Clay Loam
- 11D- Corta Silt Loam; 4-25% Slope
- 11E- Corta Silt Loam; 25-65% Slope
- 12- Bayfield Silty Clay Loam, seeped
- 12D- Dunton Loam
- 13- Big Blue Clay Loam
- 13D- Dunton Stony Loam
- 14- Bodot Clay
- 16D- Greenough Loam
- 19D- Heflin Sandy Loam
- 2- Alamosa Loam
- 22- Corta Loam
- 22A- Hunchback Clay Loam; 0-4% Slope
- 22D- Hunchback Clay Loam; 4-15% Slope
- 23- Corta Loam
- 25- Durango Cobbly Loam
- 26- Falfa Clay Loam; 1-3% Slope
- 27- Falfa Clay Loam; 3-8% Slope
- 28- Fluvaquents, Sandy, Frequently Flooded
- 29- Fortwingate Stony Sandy Loam
- 3- Badland
- 30- Fortwingate-Rock Outcrop Complex
- 30E- Mayoworth Silt Loam
- 32- Haploborolls-Rubble Land Complex
- 34- Harlan Cobbly Loam, Moist
- 36A- Nunn Loam; 0-4% Slope
- 36D- Nunn Loam; 4-25% Slope
- 37- Herm Loam
- 38A- Pescar Sandy Loam
- 39A- Riverwash
- 39- Hesperus Loam
- 42- Lazear-Rock Outcrop Complex
- 43- Sandstone Outcrop-Ustorthents Complex
- 44- Mikim Loam
- 45- Nehar Stony Sandy Loam
- 4D- Carracas Loam; 4-25% Slope
- 4E- Carracas Loam; 25-65% Slope
- 5- Arboles Clay
- 50- Pescar Fine Sandy Loam
- 53- Pinata Loam
- 58- Rock Outcrop
- 59- Sedillo Gravelly Loam
- 60- Shalona Loam
- 62- Sili Clay Loam; 1-3% Slope
- 63- Sili Clay Loam; 3-6% Slope
- 64- Simpatico Loam
- 65- Sycle Fine Sandy Loam
- 66- Tefton Loam
- 7- Archuleta-Sanchez Complex
- 70- Ustic Torriothents-Ustollic Haplargids Complex
- 74- Vosburg Fine Sandy Loam
- 76- Witt Loam
- 81- Zyme Clay Loam
- 82- Zyme Rock Outcrop Complex
- 8E- Chris Gravelly Loam



2 0 2 4 6 8 Kilometers

2 0 2 4 6 8 Miles

La Plata County transportation data provided by the La Plata County Transportation Study, 1998. Hydrologic and Archuleta County transportation features extracted from 1:100,000 USGS SDTS data. Existing wells extracted from COGCC well database and edited by BLM & USFS. Soils types digitized from the La Plata & Piedra soil surveys.

Transverse Mercator Projection 1927 North American Datum Zone 13

NORTHERN SAN JUAN BASIN CBM EIS

FIGURE 3-30
DISTRIBUTION OF SOIL MAP UNITS ACROSS THE PROJECT AREA

ANALYSIS AREA: LA PLATA & ARCHULETA COUNTIES, COLORADO

Date: 04/01/04	ArcView File: C:\994-sanjuan\proj1.apr
	Prepared By: JG

R. 9 W. R. 8 W. R. 7 W. R. 6 W. R. 5 W. R. 4 W.

T. 35 N.

T. 34 N.

T. 34 N U.

Durango

Bayfield

Gem Village

Pagosa Springs

Los Pinos River

Florida River

Beaver Creek

Squaw Creek

Spring Creek

Vallecito Creek

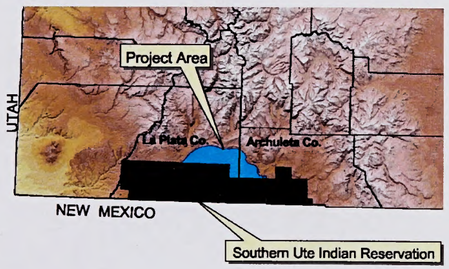
Piedra River

Farmington, NM

Ignacio

Southern Ute Indian Reservation

Southern Ute Indian Reservation



Legend

- Project Area Boundary
- Existing Compressor
- Existing Non-Fruitland Well
- Existing Fruitland Well
- Existing Disposal Well
- County Line
- U.S. Highway
- Primary Road
- Secondary Road
- Trail
- Lake/Reservoir
- Stream/River
- Fruitland Formation Outcrop
- High Potential for Wind Erosion
- High Potential for Water Erosion

N W E S

2 0 2 4 6 8 *Kilometers*

2 0 2 4 6 8 *Miles*

La Plata County transportation data provided by the La Plata County Transportation Study, 1998. Hydrologic and Archuleta County transportation features extracted from 1:100,000 USGS SDTS data. Existing wells extracted from COGCC well database and edited by BLM & USFS.

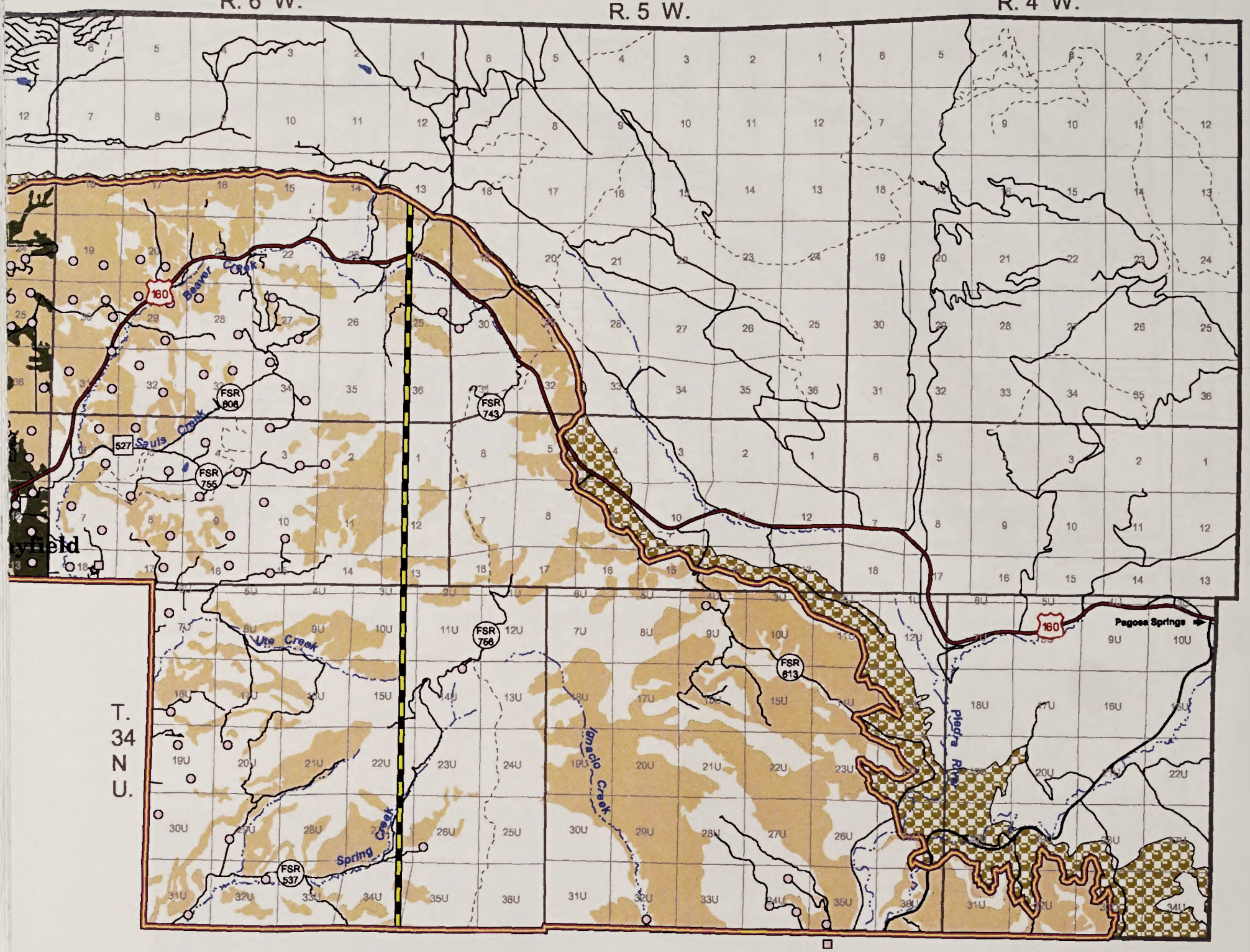
Transverse Mercator Projection
1927 North American Datum
Zone 13

NORTHERN SAN JUAN BASIN CBM EIS

FIGURE 3-31
AREAS OF HIGH POTENTIAL FOR WIND & WATER EROSION

ANALYSIS AREA: LA PLATA & ARCHULETA COUNTIES, COLORADO

Date: 04/01/04	ArcView File: C:\994-sanjuan\proj1.apr
	Prepared By: JG



Southern Ute Indian Reservation

La Plata County transportation data provided by the La Plata County Transportation Study, 1998. Hydrologic and Archuleta County transportation features extracted from 1:100,000 USGS SDTS data. Existing wells extracted from COGCC well database and edited by BLM & USFS.

8 Kilometers

6 8 Miles

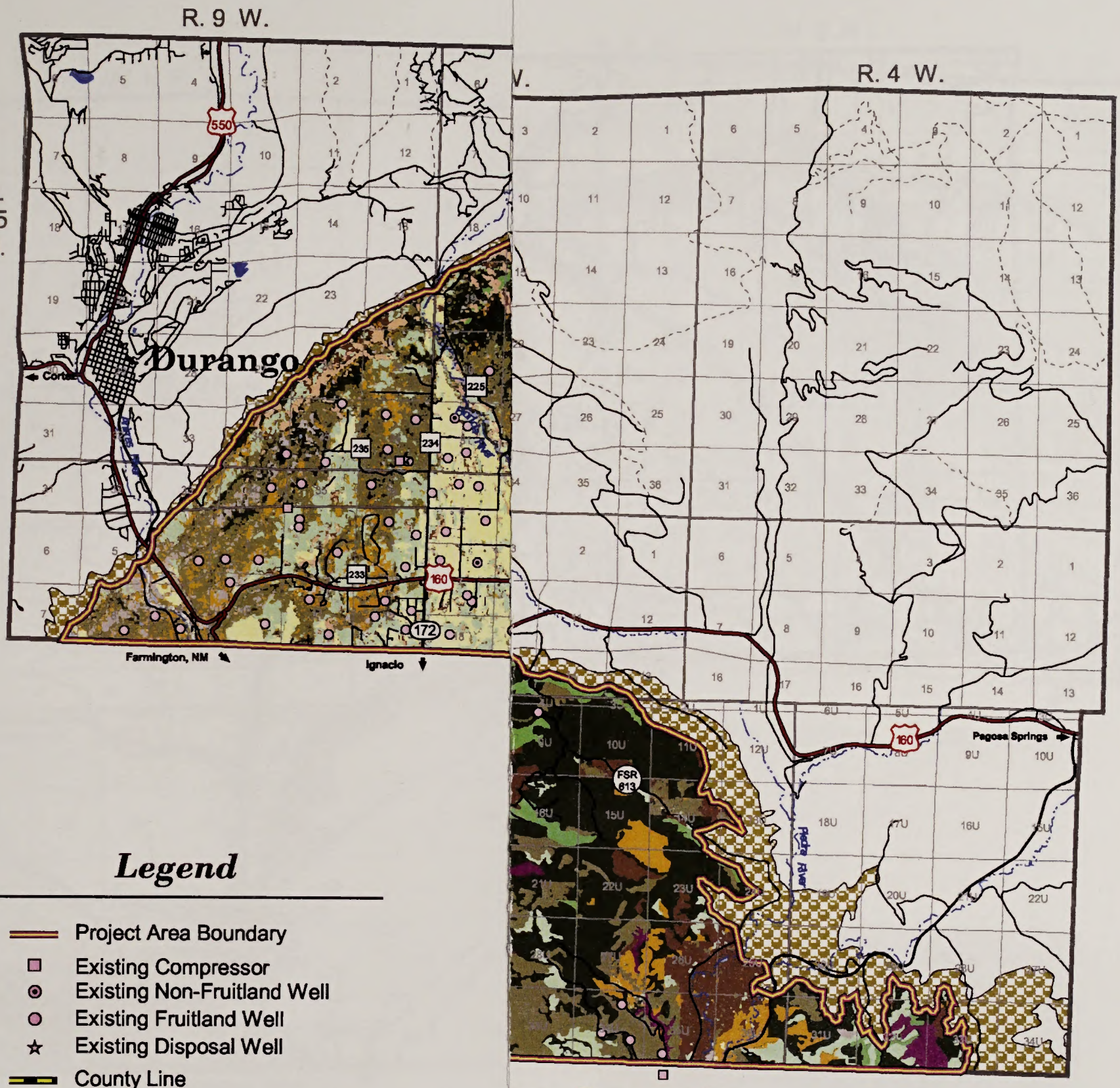
Transverse Mercator Projection
1927 North American Datum
Zone 13

NORTHERN SAN JUAN BASIN CBM EIS

FIGURE 3-32
AREAS OF PRIME FARMLAND & LOW POTENTIAL FOR REVEGETATION

ANALYSIS AREA: LA PLATA & ARCHULETA COUNTIES, COLORADO

Date: 04/01/04	ArcView File: C:\994-sanjuan\proj1.apr
	Prepared By: JG



Legend

- Project Area Boundary
- Existing Compressor
- Existing Non-Fruitland Well
- Existing Fruitland Well
- Existing Disposal Well
- County Line
- U.S. Highway
- Primary Road
- Secondary Road
- Trail
- Lake/Reservoir
- Stream/River
- Fruitland Formation Outcrop

Vegetation Types

- Agriculture
- Aspen
- Barren
- Gambel Oak
- Grasslands
- Mixed Conifer
- Mountain Shrub
- Pinyon-Juniper
- Ponderosa Pine
- Riparian
- Sagebrush
- Old Growth

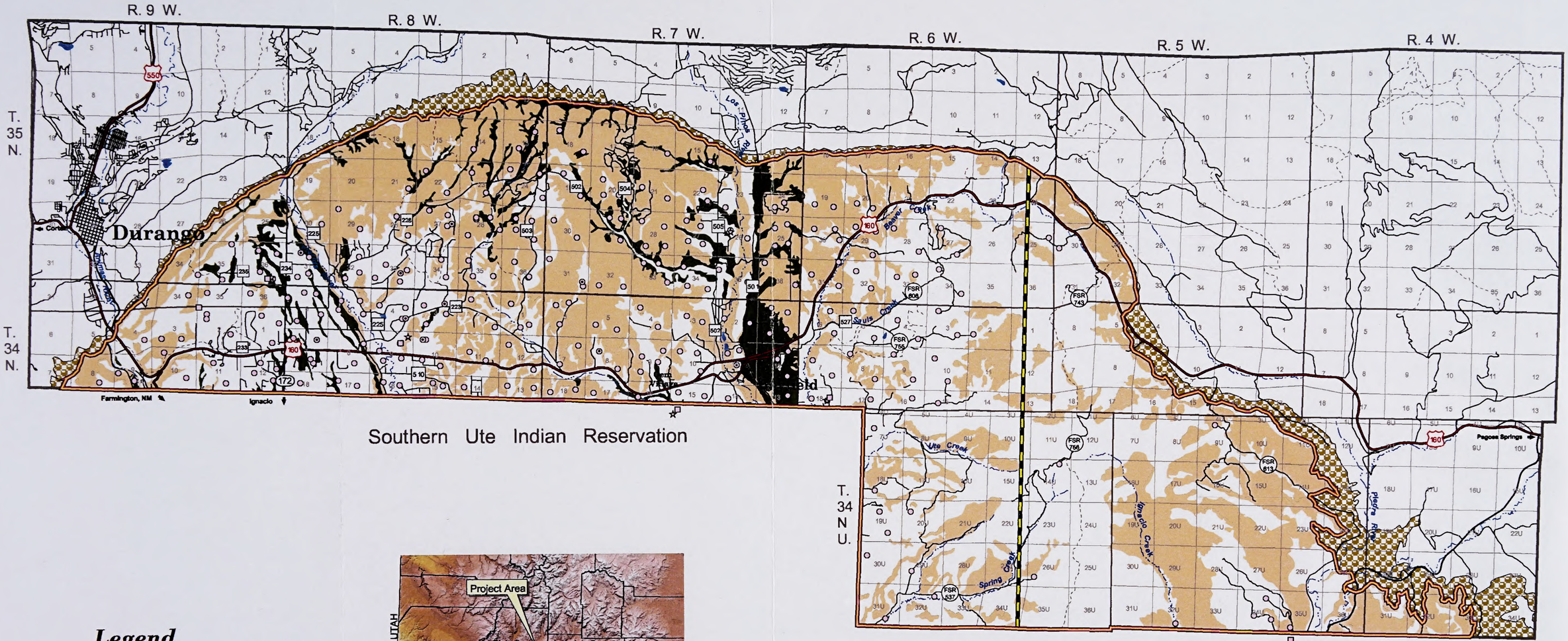
an Reservation

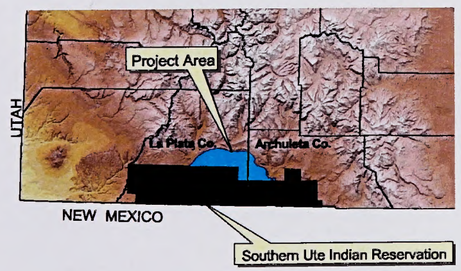
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NORTHERN SAN JUAN BASIN CBM EIS	
FIGURE 3-33 **VEGETATION**	
ANALYSIS AREA: LA PLATA & ARCHULETA COUNTIES, COLORADO	
Date: 04/01/04	ArcView File: C:\994-sanjuan\proj1.apr
	Prepared By: JG





Legend

- Project Area Boundary
- Existing Compressor
- Existing Non-Fruitland Well
- Existing Fruitland Well
- Existing Disposal Well
- County Line
- U.S. Highway
- Primary Road
- Secondary Road
- Trail
- Lake/Reservoir
- Stream/River
- Fruitland Formation Outcrop
- Prime Farmland
- Low Potential for Revegetation



2 0 2 4 6 8 *Kilometers*

2 0 2 4 6 8 *Miles*

La Plata County transportation data provided by the La Plata County Transportation Study, 1998. Hydrologic and Archuleta County transportation features extracted from 1:100,000 USGS SDTS data. Existing wells extracted from COGCC well database and edited by BLM & USFS.

Transverse Mercator Projection
1927 North American Datum
Zone 13

NORTHERN SAN JUAN BASIN CBM EIS

FIGURE 3-32
AREAS OF PRIME FARMLAND & LOW POTENTIAL FOR REVEGETATION

ANALYSIS AREA: LA PLATA & ARCHULETA COUNTIES, COLORADO

Date: 04/01/04	ArcView File: C:\994-sanjuan\proj1.apr
	Prepared By: JG

R. 9 W. R. 8 W. R. 7 W. R. 6 W. R. 5 W. R. 4 W.

T. 35 N.

T. 34 N.

Durango

Bayfield

Farmington, NM

Ignacio

Southern Ute Indian Reservation

T. 34 N. U.

Pagosa Springs

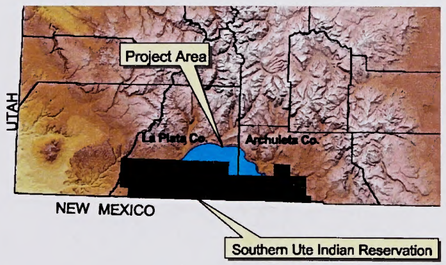
Southern Ute Indian Reservation

Legend

- Project Area Boundary
- Existing Compressor
- Existing Non-Fruitland Well
- Existing Fruitland Well
- Existing Disposal Well
- County Line
- U.S. Highway
- Primary Road
- Secondary Road
- Trail
- Lake/Reservoir
- Stream/River
- Fruitland Formation Outcrop

Vegetation Types

- Agriculture
- Aspen
- Barren
- Gambel Oak
- Grasslands
- Mixed Conifer
- Mountain Shrub
- Pinyon-Juniper
- Ponderosa Pine
- Riparian
- Sagebrush
- Old Growth



2 0 2 4 6 8 *Kilometers*

2 0 2 4 6 8 *Miles*

La Plata County transportation data provided by the La Plata County Transportation Study, 1998. Hydrologic and Archuleta County transportation features extracted from 1:100,000 USGS SDTS data.
Existing wells extracted from COGCC well database and edited by the BLM & USFS.
Vegetation data on USFS lands provided by the USFS.

Transverse Mercator Projection
1927 North American Datum
Zone 13

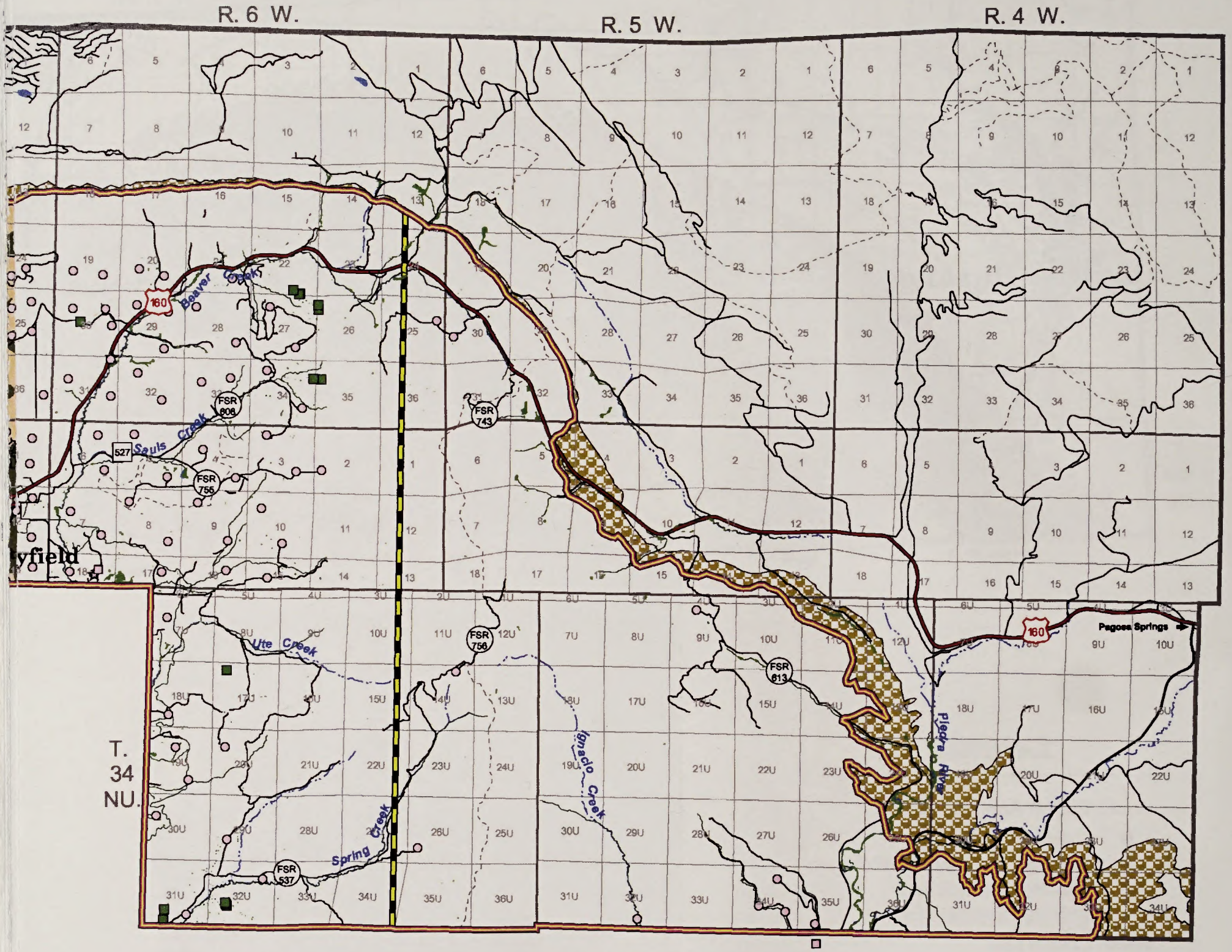
NORTHERN SAN JUAN BASIN CBM EIS

FIGURE 3-33
VEGETATION

ANALYSIS AREA: LA PLATA & ARCHULETA COUNTIES, COLORADO

Date: 04/01/04 | ArcView File: C:\994-sanjuan\proj1.apr

Prepared By: JG



Southern Ute Indian Reservation

La Plata County transportation data provided by the La Plata County Transportation Study, 1998. Hydrologic and Archuleta County transportation features extracted from 1:100,000 USGS SDTS data. Existing wells extracted from COGCC well database and edited by the BLM & USFS. Wetland data provided by the National Wetland Inventory.

8 Kilometers

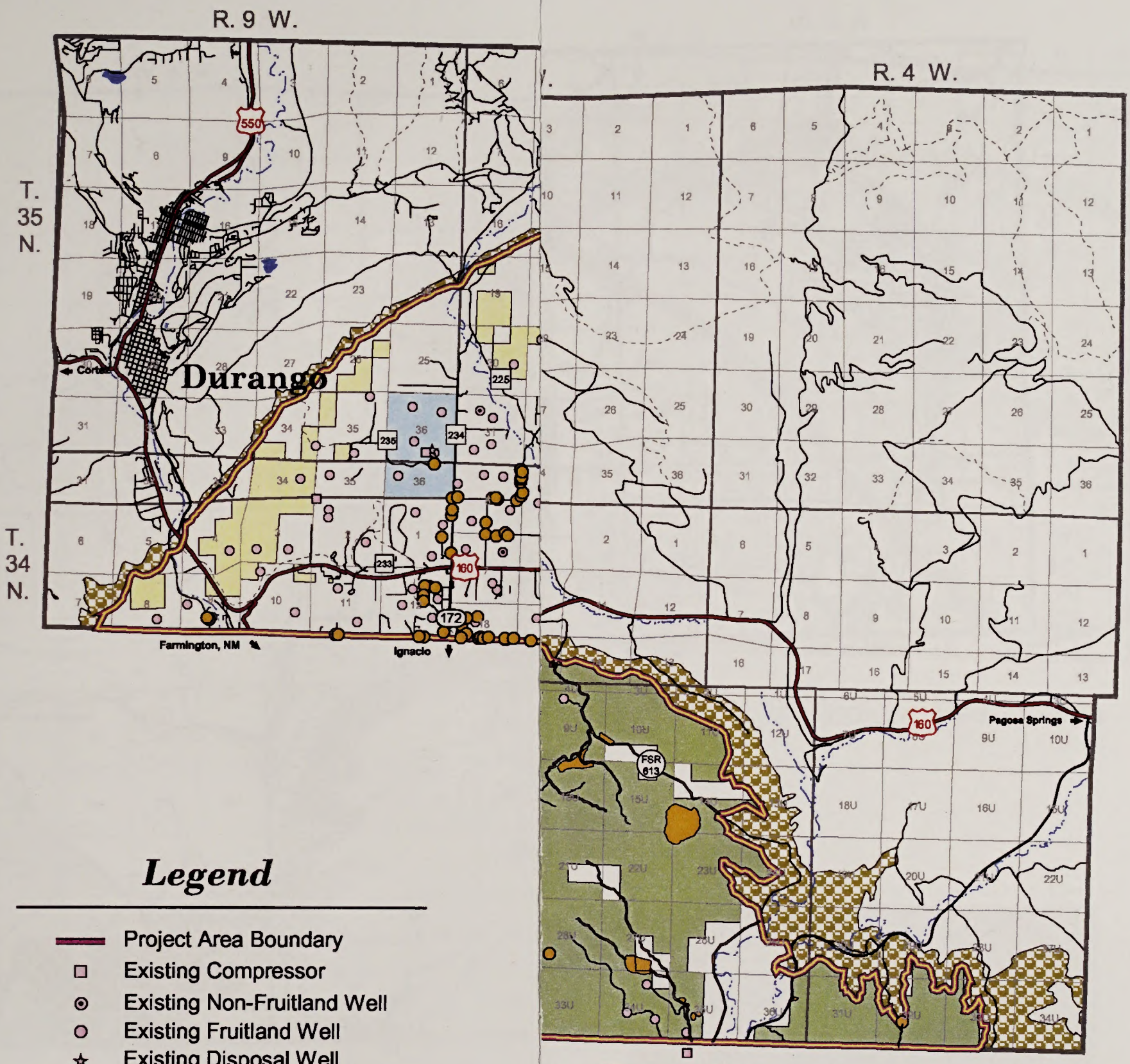
6 8 Miles

Transverse Mercator Projection
1927 North American Datum
Zone 13

NORTHERN SAN JUAN BASIN CBM EIS

FIGURE 3-34
WETLANDS

ANALYSIS AREA: LA PLATA & ARCHULETA COUNTIES, COLORADO	
Date: 04/01/04	ArcView File: C:\994-sanjuan\proj1.apr
	Prepared By: JG



Legend

- Project Area Boundary
- Existing Compressor
- Existing Non-Fruitland Well
- Existing Fruitland Well
- Existing Disposal Well
- County Line
- U.S. Highway
- Primary Road
- Secondary Road
- Trail
- Lake/Reservoir
- Stream/River
- Fruitland Formation Outcrop
- Noxious Weed Occurrance
- Noxious Weed Infestation

Surface Ownership

- BLM
- Private
- State
- USFS

an Reservation

ovided
udy, 1998.
ortation

database

NORTHERN SAN JUAN BASIN CBM EIS	
FIGURE 3-35 ***NOXIOUS WEED INFESTATIONS***	
ANALYSIS AREA: LA PLATA & ARCHULETA COUNTIES, COLORADO	
Date: 04/01/04	ArcView File: C:\994-sanjuan\proj1.apr
	Prepared By: JG

R. 9 W. R. 8 W. R. 7 W. R. 6 W. R. 5 W. R. 4 W.

T. 35 N.

T. 34 N.

Durango

Bayfield

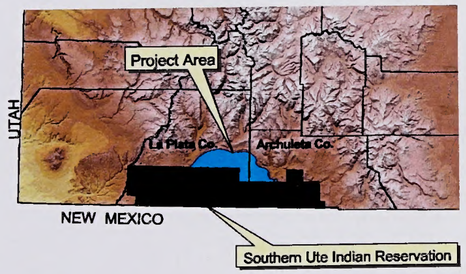
Ignacio

Farmington, NM

Southern Ute Indian Reservation

T. 34 NU.

Southern Ute Indian Reservation



Legend

- Project Area Boundary
- Existing Compressor
- Existing Non-Fruitland Well
- Existing Fruitland Well
- Existing Disposal Well
- County Line
- U.S. Highway
- Primary Road
- Secondary Road
- Trail
- Lake/Reservoir
- Stream/River
- Wetland Area
- Linear Wetland
- Wetland Location
- Fruitland Formation Outcrop

2 0 2 4 6 8 *Kilometers*

2 0 2 4 6 8 *Miles*

La Plata County transportation data provided by the La Plata County Transportation Study, 1998. Hydrologic and Archuleta County transportation features extracted from 1:100,000 USGS SDTS data.
Existing wells extracted from COGCC well database and edited by the BLM & USFS.
Wetland data provided by the National Wetland Inventory.

Transverse Mercator Projection
1927 North American Datum
Zone 13

NORTHERN SAN JUAN BASIN CBM EIS

FIGURE 3-34
WETLANDS

ANALYSIS AREA: LA PLATA & ARCHULETA COUNTIES, COLORADO

Date: 04/01/04	ArcView File: C:\994-sanjuan\proj1.apr
	Prepared By: JG

R. 9 W. R. 8 W. R. 7 W. R. 6 W. R. 5 W. R. 4 W.

T. 35 N.

T. 34 N.

Durango

Bayfield

Gem Village

Ignacio

Farmington, NM

Pagosa Springs

Southern Ute Indian Reservation

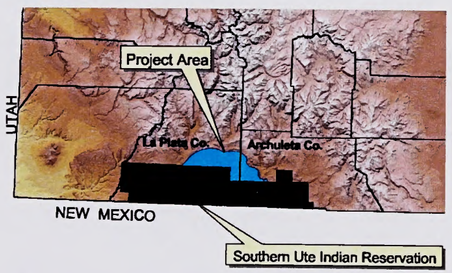
T. 34 N. U.

Southern Ute Indian Reservation

Legend

- Project Area Boundary
- Existing Compressor
- Existing Non-Fruitland Well
- Existing Fruitland Well
- Existing Disposal Well
- County Line
- U.S. Highway
- Primary Road
- Secondary Road
- Trail
- Lake/Reservoir
- Stream/River
- Fruitland Formation Outcrop
- Noxious Weed Occurrance
- Noxious Weed Infestation

Surface Ownership
- BLM
- Private
- State
- USFS



2 0 2 4 6 8 *Kilometers*

2 0 2 4 6 8 *Miles*

La Plata County transportation data provided by the La Plata County Transportation Study, 1998. Hydrologic and Archuleta County transportation features extracted from 1:100,000 USGS SDTS data.
Existing wells extracted from COGCC well database and edited by BLM & USFS.

Transverse Mercator Projection
1927 North American Datum
Zone 13

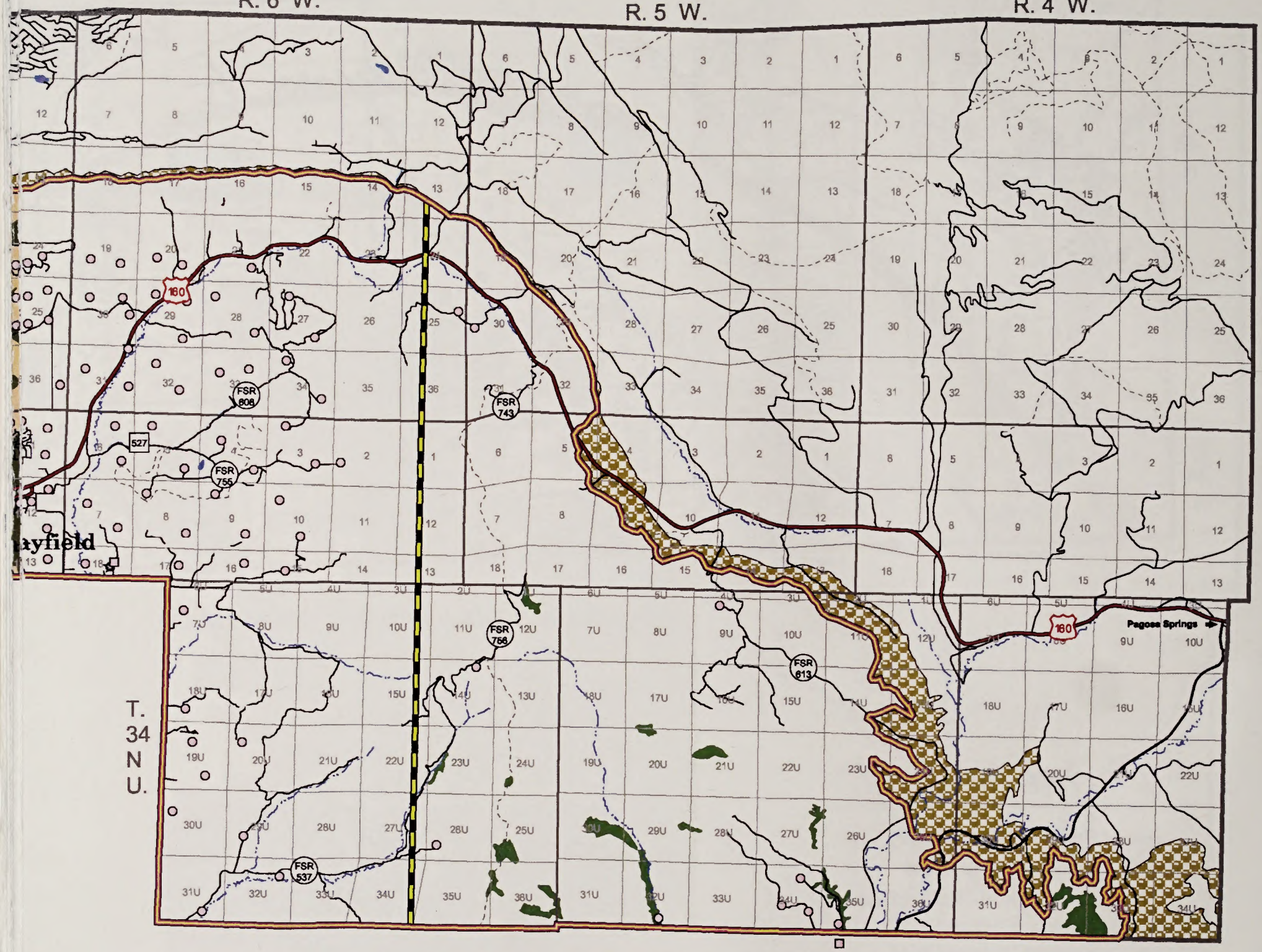
NORTHERN SAN JUAN BASIN CBM EIS

FIGURE 3-35
NOXIOUS WEED INFESTATIONS

ANALYSIS AREA: LA PLATA & ARCHULETA COUNTIES, COLORADO

Date: 04/01/04 | ArcView File: C:\994-sanjuan\proj1.apr

Prepared By: JG



La Plata County transportation data provided by the La Plata County Transportation Study, 1998. Hydrologic and Archuleta County transportation features extracted from 1:100,000 USGS SDTS data. Old Growth areas identified by the USFS. Existing wells extracted from COGCC well database and edited by BLM & USFS.

8 Kilometers

6 8 Miles

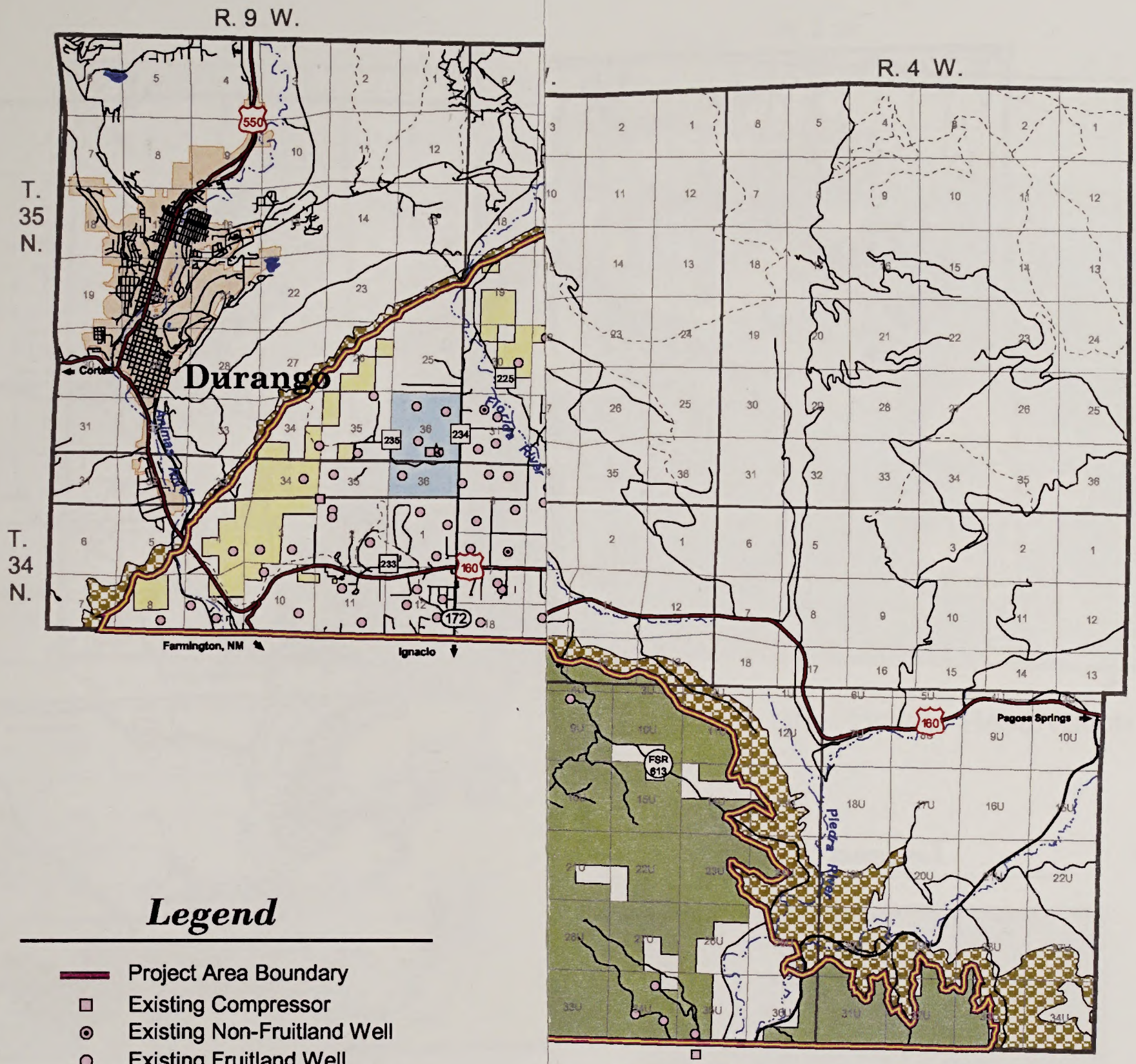
Transverse Mercator Projection
1927 North American Datum
Zone 13

NORTHERN SAN JUAN BASIN CBM EIS

FIGURE 3-36
OLD GROWTH AREAS

ANALYSIS AREA: LA PLATA & ARCHULETA COUNTIES, COLORADO

Date: 04/01/04	ArcView File: C:\994-sanjuan\proj1.apr
	Prepared By: JG



Legend

- Project Area Boundary
- Existing Compressor
- Existing Non-Fruitland Well
- Existing Fruitland Well
- Existing Disposal Well
- County Line
- U.S. Highway
- Primary Road
- Secondary Road
- Trail
- Lake/Reservoir
- Stream/River
- Municipal Area
- Fruitland Formation Outcrop

Land Ownership

- BLM Public Lands
- Private
- State
- National Forest

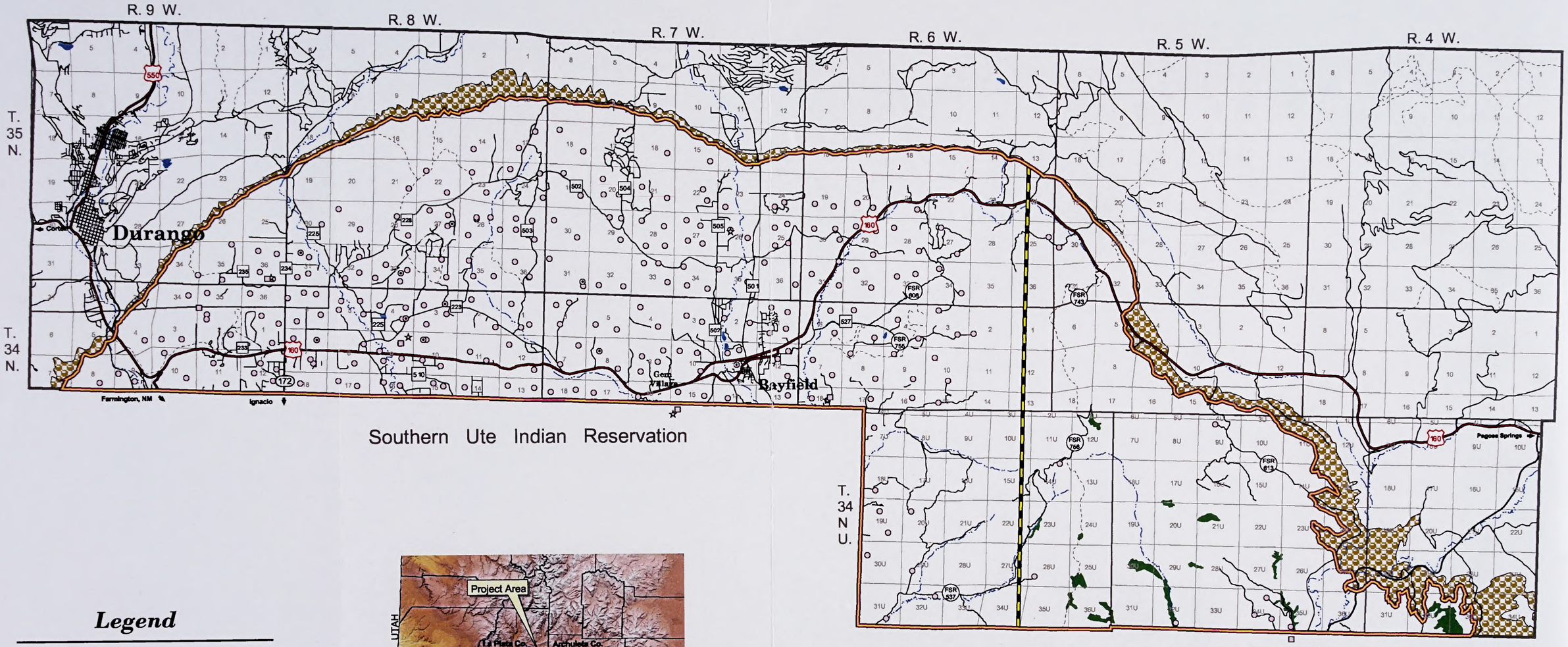
an Reservation

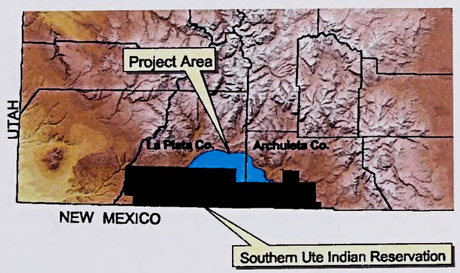
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udy, 1998.
ortation

database

USFS.

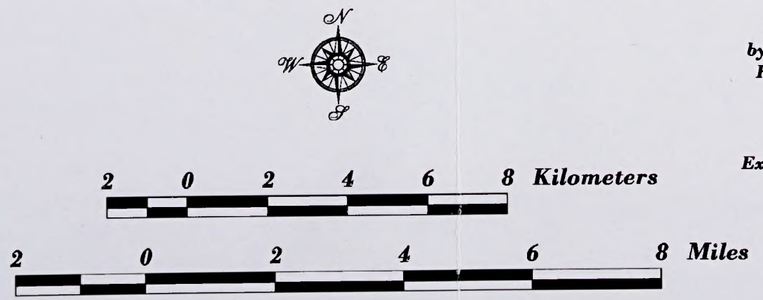
NORTHERN SAN JUAN BASIN CBM EIS	
FIGURE 3-37 **SURFACE OWNERSHIP**	
ANALYSIS AREA: LA PLATA & ARCHULETA COUNTIES, COLORADO	
Date: 04/01/04	ArcView File: C:\994-sanjuan\proj1.apr
	Prepared By: JG





Legend

- Project Area Boundary
- Existing Compressor
- Existing Non-Fruitland Well
- Existing Fruitland Well
- Existing Disposal Well
- County Line
- U.S. Highway
- Primary Road
- Secondary Road
- Trail
- Lake/Reservoir
- Stream/River
- Fruitland Formation Outcrop
- Old Growth



La Plata County transportation data provided by the La Plata County Transportation Study, 1998. Hydrologic and Archuleta County transportation features extracted from 1:100,000 USGS SDTS data. Old Growth areas identified by the USFS. Existing wells extracted from COGCC well database and edited by BLM & USFS.

Transverse Mercator Projection
1927 North American Datum
Zone 13

NORTHERN SAN JUAN BASIN CBM EIS

FIGURE 3-36
OLD GROWTH AREAS

ANALYSIS AREA: LA PLATA & ARCHULETA COUNTIES, COLORADO	
Date: 04/01/04	ArcView File: C:\994-sanjuan\proj1.apr
	Prepared By: JG

R. 9 W. R. 8 W. R. 7 W. R. 6 W. R. 5 W. R. 4 W.

T. 35 N.

T. 34 N.

Durango

Bayfield

Gem Village

Vallecito Reservoir

Lake Nighthorse

Animas River

Los Pinos River

Beaver Creek

Sauls Creek

Ute Creek

Spring Creek

Pagosa Springs

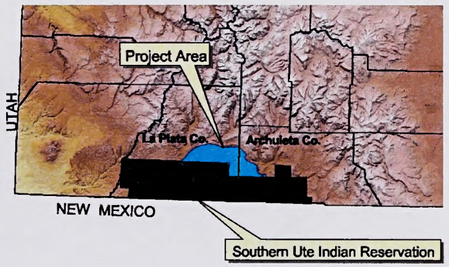
Farmington, NM

Ignacio

Southern Ute Indian Reservation

T. 34 N. U.

Southern Ute Indian Reservation



Legend

- Project Area Boundary
- Existing Compressor
- Existing Non-Fruitland Well
- Existing Fruitland Well
- Existing Disposal Well
- County Line
- U.S. Highway
- Primary Road
- Secondary Road
- Trail
- Lake/Reservoir
- Stream/River
- Municipal Area
- Fruitland Formation Outcrop

Land Ownership
- BLM Public Lands
- Private
- State
- National Forest

N W E S

2 0 2 4 6 8 *Kilometers*

2 0 2 4 6 8 *Miles*

La Plata County transportation data provided by the La Plata County Transportation Study, 1998. Hydrologic and Archuleta County transportation features extracted from 1:100,000 USGS SDTS data.
Existing wells extracted from COGCC well database and edited by BLM & USFS.
Surface ownership data provided by the USFS.

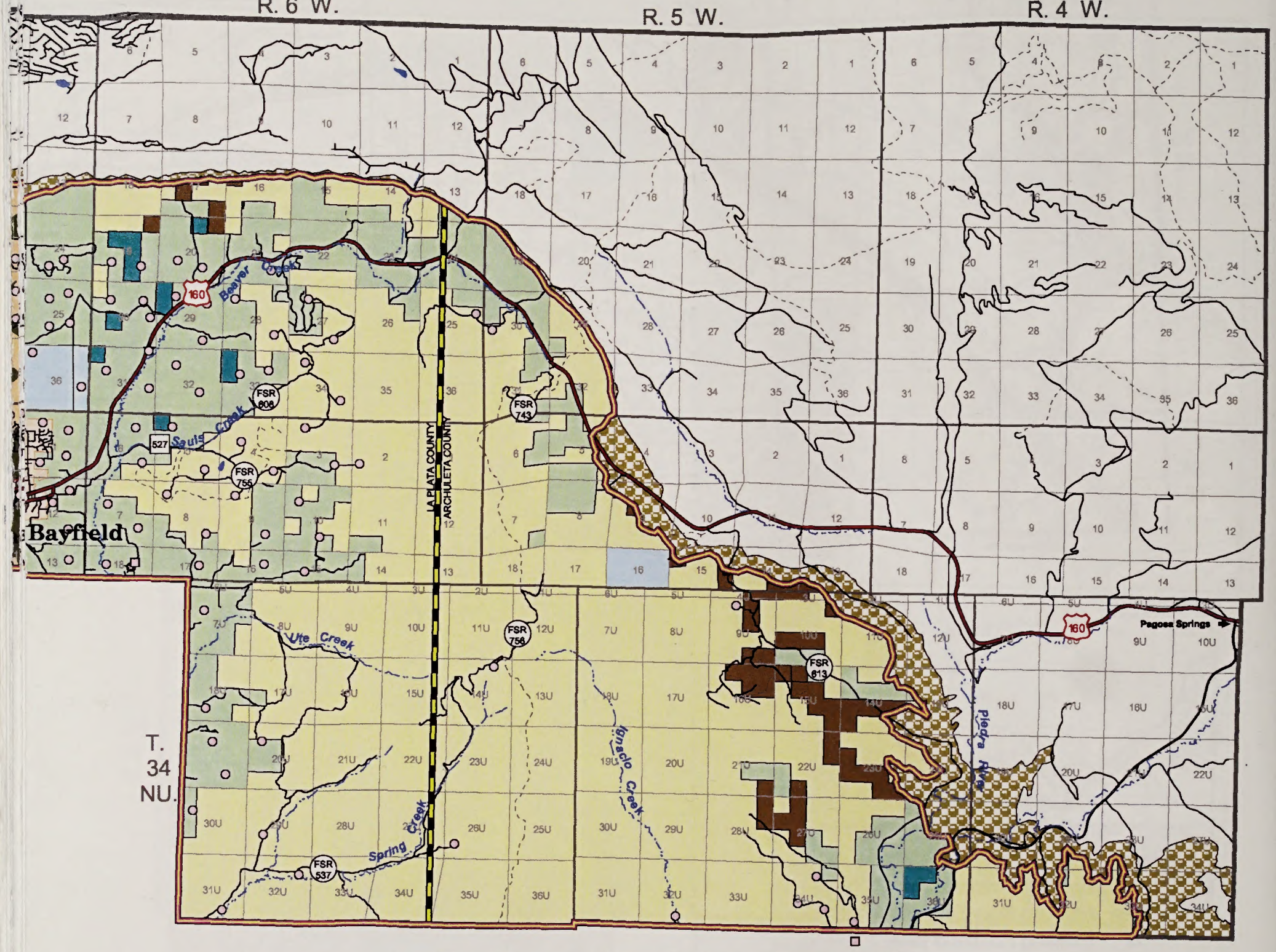
Transverse Mercator Projection
1927 North American Datum
Zone 13

NORTHERN SAN JUAN BASIN CBM EIS

FIGURE 3-37
SURFACE OWNERSHIP

ANALYSIS AREA: LA PLATA & ARCHULETA COUNTIES, COLORADO

Date: 04/01/04	ArcView File: C:\994-sanjuan\proj1.apr
	Prepared By: JG



Southern Ute Indian Reservation

La Plata County transportation data provided by the La Plata County Transportation Study, 1998. Hydrologic and Archuleta County transportation features extracted from 1:100,000 USGS SDTS data.
Existing wells extracted from COGCC well database and edited by the BLM & USFS.
Ownership data provided by the USFS.

8 Kilometers

6 8 Miles

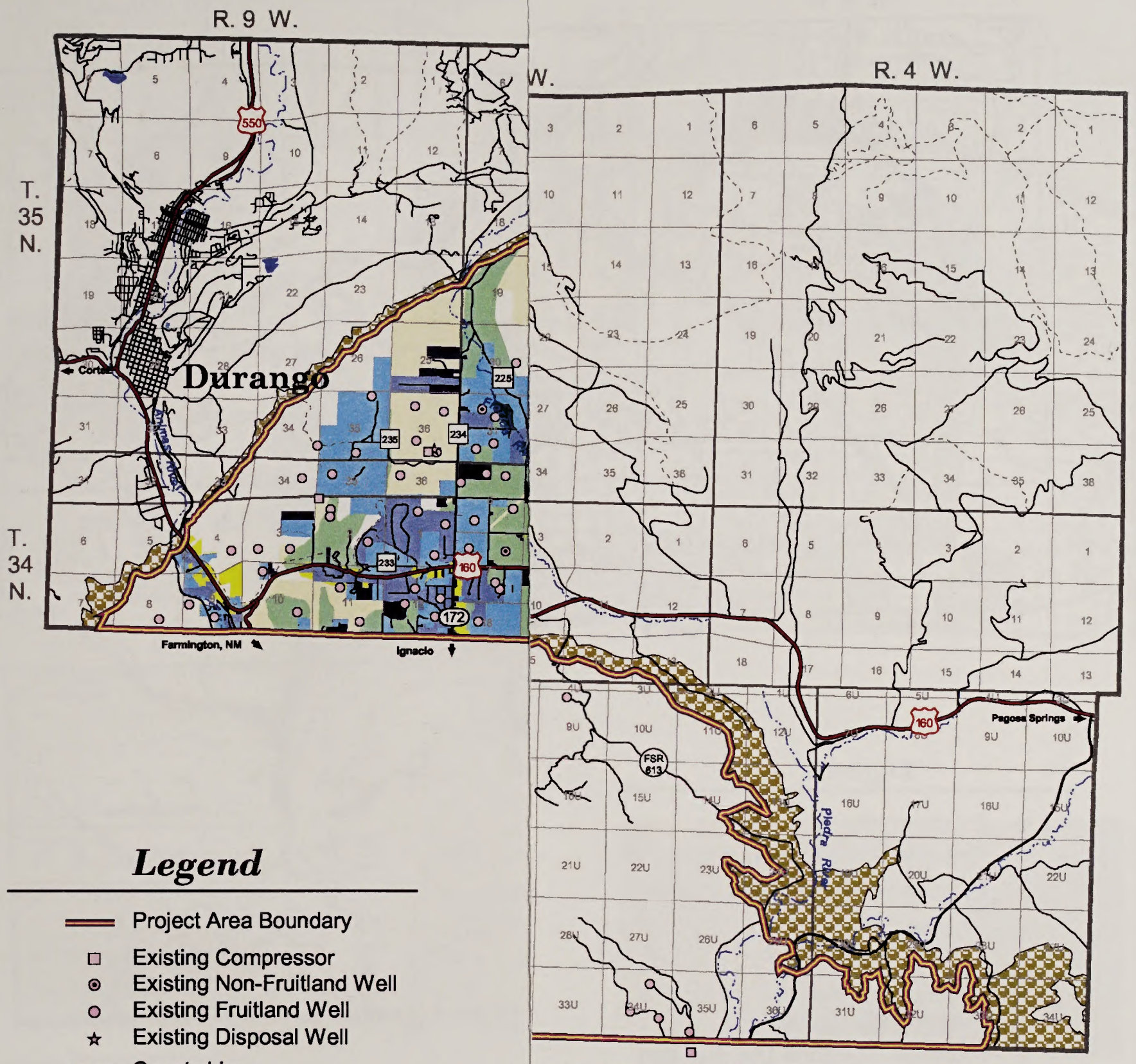
Transverse Mercator Projection
1927 North American Datum
Zone 13

NORTHERN SAN JUAN BASIN CBM EIS

FIGURE 3-38
MINERAL OWNERSHIP

ANALYSIS AREA: LA PLATA & ARCHULETA COUNTIES, COLORADO

Date: 04/01/04	ArcView File: C:\994-sanjuan\proj1.apr
	Prepared By: JG


R. 9 W.
R. 4 W.
T. 35 N.
T. 34 N.
Durango
Cortez
Farmington, NM
Ignacio
Pagosa Springs
Pleasant View
Pleasant View
Pleasant View

R. 9 W. R. 8 W. R. 7 W. R. 6 W. R. 5 W. R. 4 W.

T. 35 N.

T. 34 N.

T. 34 NU.

Durango

Bayfield

Ft Bayfield

Farmington, NM

Ignacio

Pagosa Springs

Los Pinos River

Florida River

Beaver Creek

Saul's Creek

Ute Creek

Spring Creek

Bracido Creek

LA PLATA COUNTY
ARCHULETA COUNTY

Southern Ute Indian Reservation

Southern Ute Indian Reservation

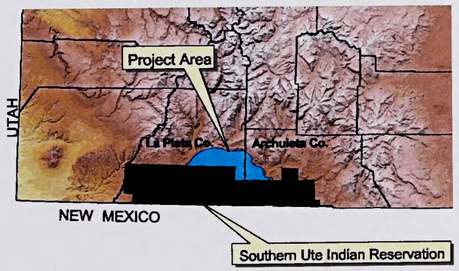
Legend

- Project Area Boundary
- Existing Compressor
- Existing Non-Fruitland Well
- Existing Fruitland Well
- Existing Disposal Well
- County Line
- U.S. Highway
- Primary Road
- Secondary Road
- Trail
- Lake/Reservoir
- Stream/River
- Municipal Area
- Fruitland Formation Outcrop

Ownership

- Federal Surface/Private Mineral
- Private Surface/Federal Mineral
- Federal Surface/Federal Mineral
- Private Surface/Private Mineral
- State Surface/State Mineral

** Private ownership may be in split estate*



N W E S

2 0 2 4 6 8 *Kilometers*

2 0 2 4 6 8 *Miles*

La Plata County transportation data provided by the La Plata County Transportation Study, 1998. Hydrologic and Archuleta County transportation features extracted from 1:100,000 USGS SDTS data.
Existing wells extracted from COGCC well database and edited by the BLM & USFS.
Ownership data provided by the USFS.

Transverse Mercator Projection
1927 North American Datum
Zone 13

NORTHERN SAN JUAN BASIN CBM EIS

FIGURE 3-38
MINERAL OWNERSHIP

ANALYSIS AREA: LA PLATA & ARCHULETA COUNTIES, COLORADO

Date: 04/01/04	ArcView File: C:\994-sanjuan\proj1.apr
	Prepared By: JG

R. 9 W. R. 8 W. R. 7 W. R. 6 W. R. 5 W. R. 4 W.

T. 35 N.

T. 34 N.

T. 34 N U.

Durango

Farmington, NM

Ignacio

Bayfield

Pagosa Springs

Southern Ute Indian Reservation

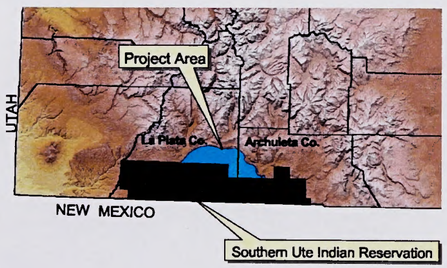
Southern Ute Indian Reservation

Legend

- Project Area Boundary
- Existing Compressor
- Existing Non-Fruitland Well
- Existing Fruitland Well
- Existing Disposal Well
- County Line
- U.S. Highway
- Primary Road
- Secondary Road
- Trail
- Lake/Reservoir
- Stream/River
- Fruitland Formation Outcrop

Land Use Categories

- Urban
- Residential
  - Existing Subdivision
  - Proposed Subdivision
- Agriculture-Rangeland
  - Irrigated (not prime)
  - Prime Irrigated
- Undeveloped



2 0 2 4 6 8 *Kilometers*

2 0 2 4 6 8 *Miles*

Existing land use data provided by the La Plata County Planning District Land Use Classification maps and the Archuleta County Community Plan, 2001, and the Important Farmlands Map of La Plata County, USDS, NRCS.

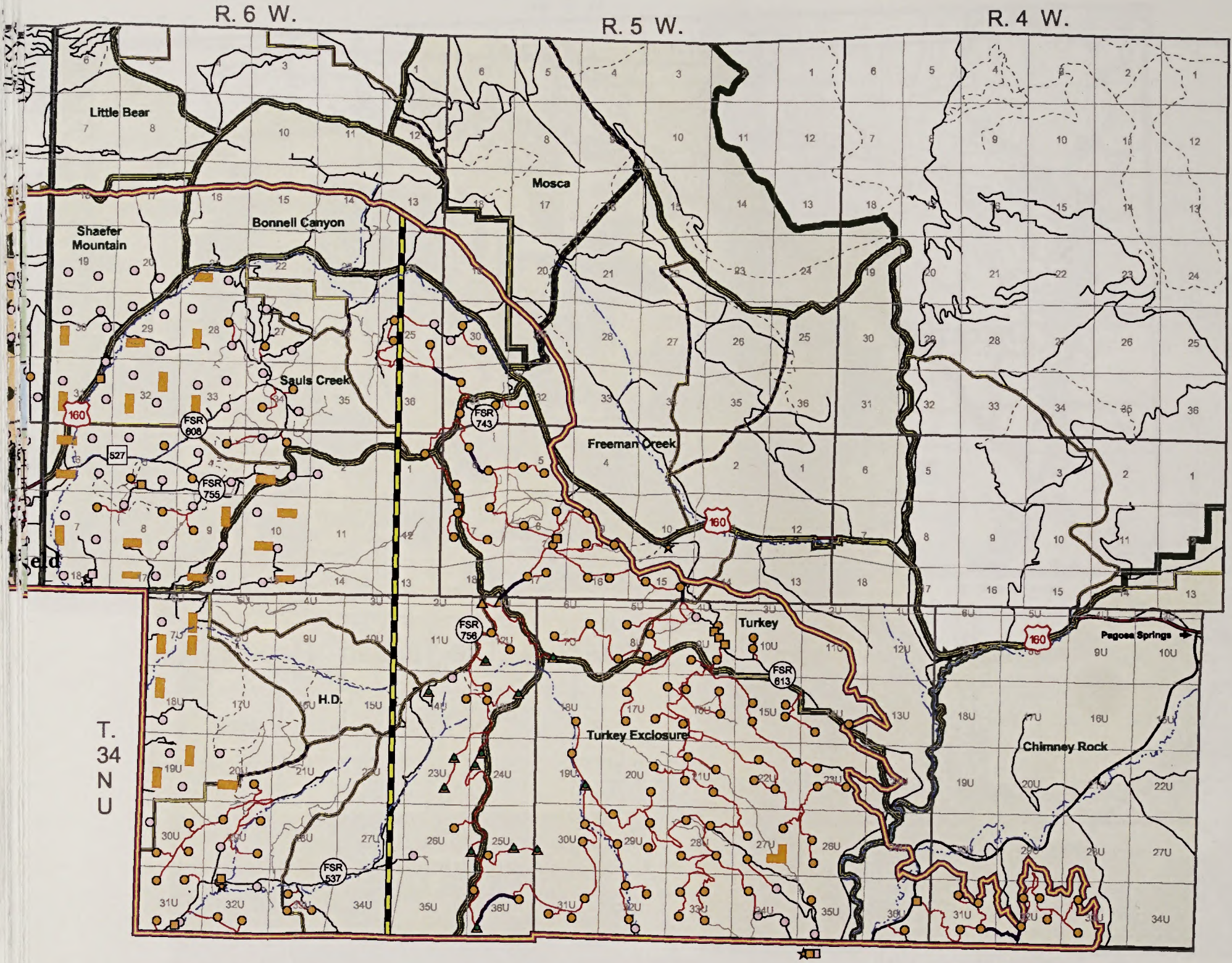
La Plata County transportation data provided by the La Plata County Transportation Study, 1998. Hydrologic and Archuleta County transportation features extracted from 1:100,000 USGS SDTS data.
Existing wells extracted from COGCC well database and edited by the BLM & USFS.

Transverse Mercator Projection
1927 North American Datum
Zone 13

NORTHERN SAN JUAN BASIN CBM EIS

FIGURE 3-39
DISTRIBUTION OF EXISTING LAND USES

ANALYSIS AREA: LA PLATA & ARCHULETA COUNTIES, COLORADO	
Date: 04/01/04	ArcView File: C:\994-sanjuan\proj1.apr
	Prepared By: JG



La Plata County transportation data provided by the La Plata County Transportation Study, 1998. Hydrologic and Archuleta County transportation features extracted from 1:100,000 USGS SDTS data. Existing wells extracted from COGCC well database and edited by the BLM & USFS.

Kilometers

6 8 Miles

Transverse Mercator Projection
1927 North American Datum
Zone 13

NORTHERN SAN JUAN BASIN CBM EIS

FIGURE 3-40
RANGE MANAGEMENT & COMPANIES' PROPOSED ACTION

ANALYSIS AREA: LA PLATA & ARCHULETA COUNTIES, COLORADO

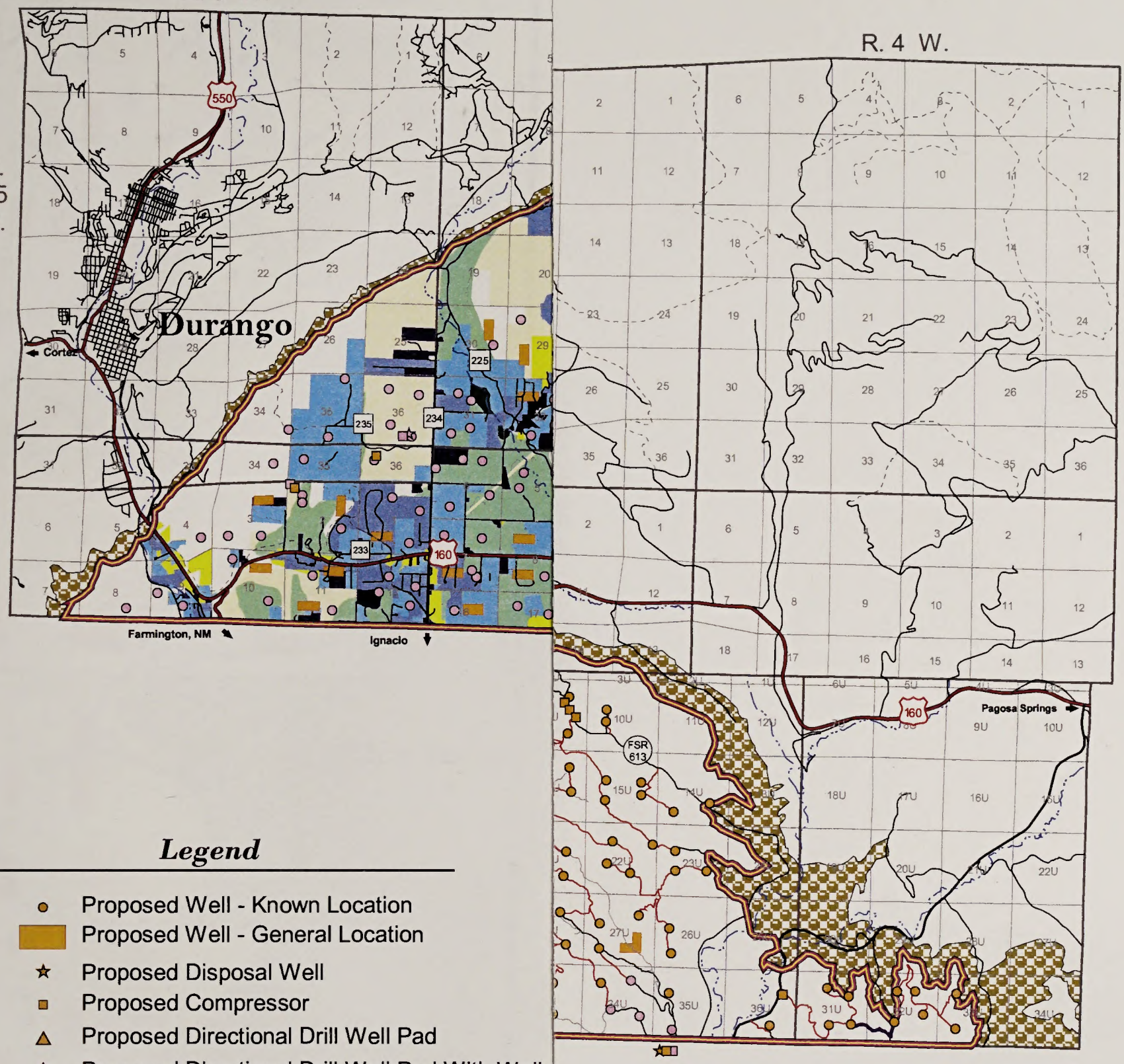
Date: 04/01/04	ArcView File: C:\994-sanjuan\proposal.apr
	Prepared By: JG

R. 9 W.

R. 4 W.

T. 35 N.

T. 34 N.



Legend

- Proposed Well - Known Location
- Proposed Well - General Location
- Proposed Disposal Well
- Proposed Compressor
- Proposed Directional Drill Well Pad
- Proposed Directional Drill Well Pad With Well
- Proposed Flowline
- Proposed Access Road/Flowline
- Project Area Boundary
- U.S. Highway
- Primary Road
- Secondary Road
- Closed USFS Road
- Trail
- River/Stream
- Urban
- Residential
  - Existing Subdivision
  - Proposed Subdivision
- Agriculture-Rangeland
  - Irrigated (not prime)
  - Prime Irrigated
- Undeveloped

Plata
cation
lan, 2001,
Plata

ided
y, 1998.
tation

atabase

NORTHERN SAN JUAN BASIN CBM EIS	
FIGURE 3-41 ***DISTRIBUTION OF PROPOSED CBM FACILITIES ACROSS LAND USE CATEGORIES, ALTERNATIVE 1***	
ANALYSIS AREA: LA PLATA & ARCHULETA COUNTIES, COLORADO	
Date: 04/01/04	ArcView File: C:\994-sanjuan\proposal.apr
	Prepared By: JG

R. 9 W. R. 8 W. R. 7 W. R. 6 W. R. 5 W. R. 4 W.

T. 35 N.

T. 34 N.

Durango

Bayfield

Farmington, NM

Ignacio

Cortez

W Vosberg Pike

Florida River

Horse Gulch

Palmer

Palmer

W Rabbit Mtn

Wallace Gulch

Wallace Gulch

N Canby

S Canby

Gem Village

Mahan

Little Bear

Shaefer Mountain

Bonnell Canyon

Mosca

Sauls Creek

Freeman Creek

Turkey

Turkey Exclosure

Chimney Rock

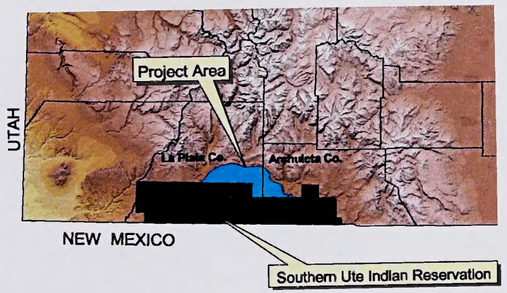
Pagosa Springs

H.D.

T. 34 N U

Legend

- Existing Well
- Proposed Well - Known Location
- Proposed Well - General Location
- Proposed Disposal Well
- Existing Disposal Well
- Existing Compressor
- Proposed Compressor
- Proposed Directional Drill Well Pad
- Proposed Directional Drill Well Pad With Well
- Proposed Flowline
- Proposed Access Road/Flowline
- Project Area Boundary
- U.S. Highway
- Primary Road
- Secondary Road
- Closed USFS Road
- Trail
- River/Stream
- Fence Infra Data
- Pasture Boundary
- Forest Service Allotments
- BLM Allotments
- Fruitland Outcrop



2 0 2 4 6 8 Kilometers

2 0 2 4 6 8 Miles

La Plata County transportation data provided by the La Plata County Transportation Study, 1998. Hydrologic and Archuleta County transportation features extracted from 1:100,000 USGS SDTS data. Existing wells extracted from COGCC well database and edited by the BLM & USFS.

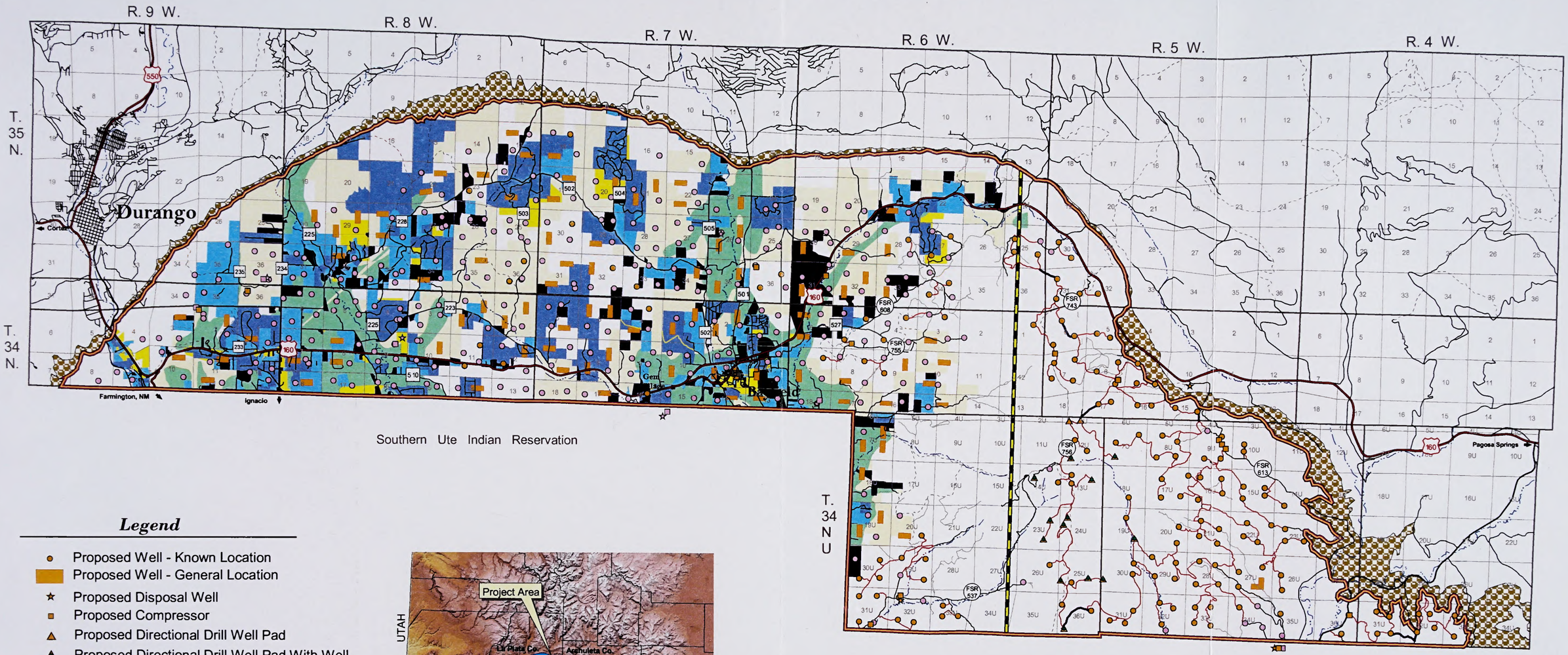
Transverse Mercator Projection 1927 North American Datum Zone 13

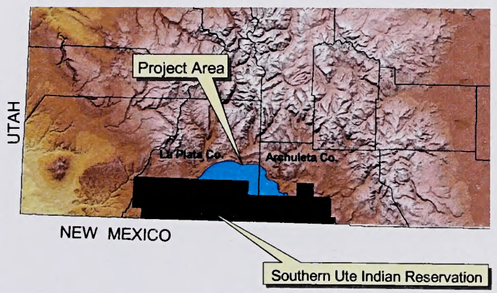
NORTHERN SAN JUAN BASIN CBM EIS

FIGURE 3-40
RANGE MANAGEMENT & COMPANIES' PROPOSED ACTION

ANALYSIS AREA: LA PLATA & ARCHULETA COUNTIES, COLORADO

Date: 04/01/04	ArcView File: C:\994-sanjuan\proposal.apr
	Prepared By: JG





Legend

- Proposed Well - Known Location
- Proposed Well - General Location
- Proposed Disposal Well
- Proposed Compressor
- Proposed Directional Drill Well Pad
- Proposed Directional Drill Well Pad With Well
- Proposed Flowline
- Proposed Access Road/Flowline
- Project Area Boundary
- U.S. Highway
- Primary Road
- Secondary Road
- Closed USFS Road
- Trail
- River/Stream
- Urban
- Residential
  - Existing Subdivision
  - Proposed Subdivision
- Agriculture-Rangeland
  - Irrigated (not prime)
  - Prime Irrigated
- Undeveloped



2 0 2 4 6 8 *Kilometers*

2 0 2 4 6 8 *Miles*

Existing land use data provided by the La Plata County Planning District Land Use Classification maps and the Archuleta County Community Plan, 2001, and the Important Farmlands map of La Plata County, USDS, NRCS.

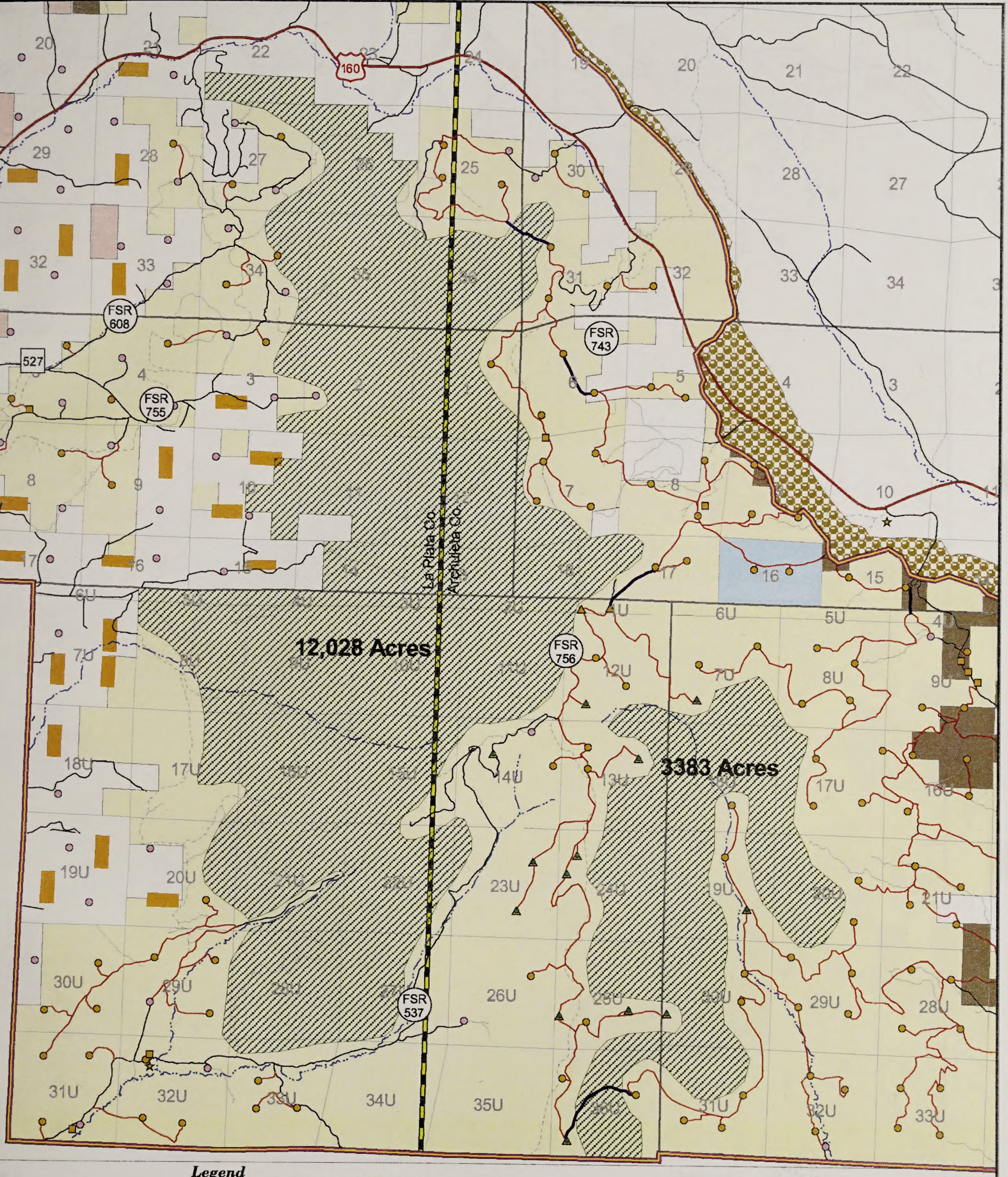
La Plata County transportation data provided by the La Plata County Transportation Study, 1998. Hydrologic and Archuleta County transportation features extracted from 1:100,000 USGS SDTS data.
Existing wells extracted from COGCC well database and edited by the BLM & USFS.

Transverse Mercator Projection
1927 North American Datum
Zone 13

NORTHERN SAN JUAN BASIN CBM EIS

FIGURE 3-41
DISTRIBUTION OF PROPOSED CBM FACILITIES ACROSS LAND USE CATEGORIES, ALTERNATIVE 1

ANALYSIS AREA: LA PLATA & ARCHULETA COUNTIES, COLORADO	
Date: 04/01/04	ArcView File: C:\994-sanjuan\proposal.apr
	Prepared By: JG



Legend

- Existing Well
- Proposed Well - Known Location
- Proposed Well - General Location
- Proposed Disposal Well
- Existing Disposal Well
- Existing Compressor
- Proposed Compressor
- Proposed Directional Drill Well Pad
- Proposed Directional Drill Well Pad With Well
- Proposed Access Road/Flowline
- Proposed Flowline
- Project Area Boundary
- U.S. Highway
- Primary Road
- Secondary Road
- River/Stream

Surface Ownership/Mineral Ownership

- Federal/Federal
- Federal/Private
- Private/Private
- Private/Federal
- State/State
- Projected Roadless Area
- Fruitland Outcrop

Transverse Mercator Projection
1927 North American Datum
Zone 13

0 1 2 Miles

NORTHERN SAN JUAN BASIN CBM EIS

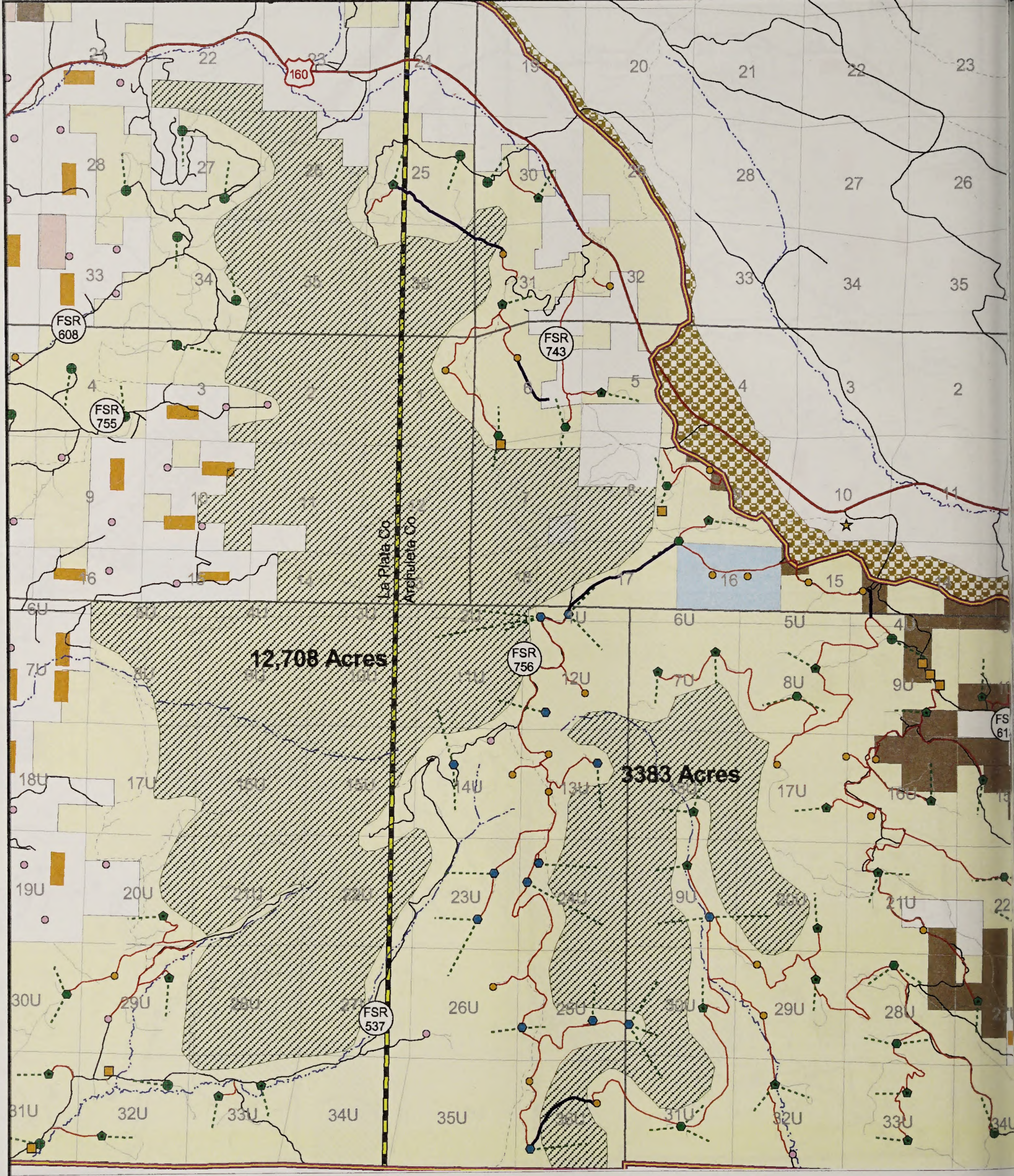
FIGURE 3-42
ALTERNATIVE 1
PROJECTED ROADLESS AREA

ANALYSIS AREA: LA PLATA & ARCHULETA COUNTIES, COLORADO

Date: 04/01/04

ArcView File: C:\994-sanjuan\roadless.apr

Prepared By: JG



Legend

- Existing Well
- Proposed Well - Known Location
- Proposed Well - General Location
- Proposed Disposal Well
- Existing Disposal Well
- Existing Compressor
- Proposed Compressor
- Proposed Directional Drill Well Pad
- Proposed Directional Drill Well Pad With Well
- Proposed Access Road/Flowline
- Proposed Flowline
- Project Area Boundary
- U.S. Highway
- Primary Road
- Secondary Road
- River/Stream

Surface Ownership/Mineral Ownership

- Federal/Federal
- Federal/Private
- Private/Private
- Private/Federal
- State/State
- Projected Roadless Area
- Fruitland Outcrop

Transverse Mercator Projection
1927 North American Datum
Zone 13

0 1 2 Miles

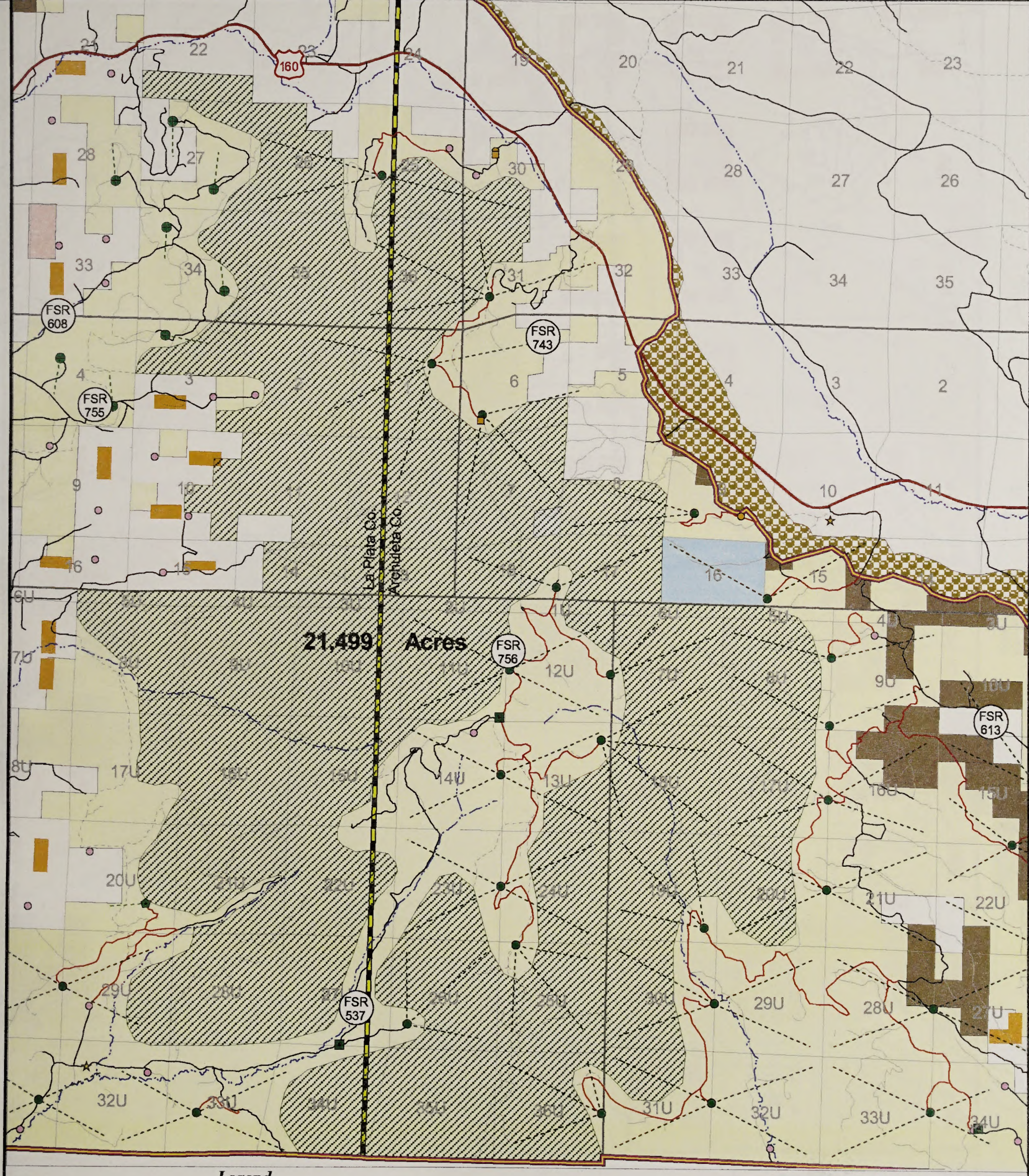
NORTHERN SAN JUAN BASIN CBM EIS

FIGURE 3-43
ALTERNATIVE 1A
PROJECTED ROADLESS AREA

ANALYSIS AREA: LA PLATA & ARCHULETA COUNTIES, COLORADO

Date: 04/01/04 | ArcView File: C:\994-san juan\roadless.ap

Prepared By: JG



Legend

- Existing Well
- Proposed Well - Known Location
- Proposed Well - General Location
- Proposed Disposal Well
- Existing Disposal Well
- Existing Compressor
- Proposed Compressor
- Proposed Directional Drill Well Pad
- Proposed Directional Drill Well Pad With Well
- Proposed Access Road/Flowline
- Proposed Flowline
- Project Area Boundary
- U.S. Highway
- Primary Road
- Secondary Road
- River/Stream

Surface Ownership/Mineral Ownership

- Federal/Federal
- Federal/Private
- Private/Private
- Private/Federal
- State/State
- Projected Roadless Area
- Fruitland Outcrop

Transverse Mercator Projection
1927 North American Datum
Zone 13

0 1 2 Miles

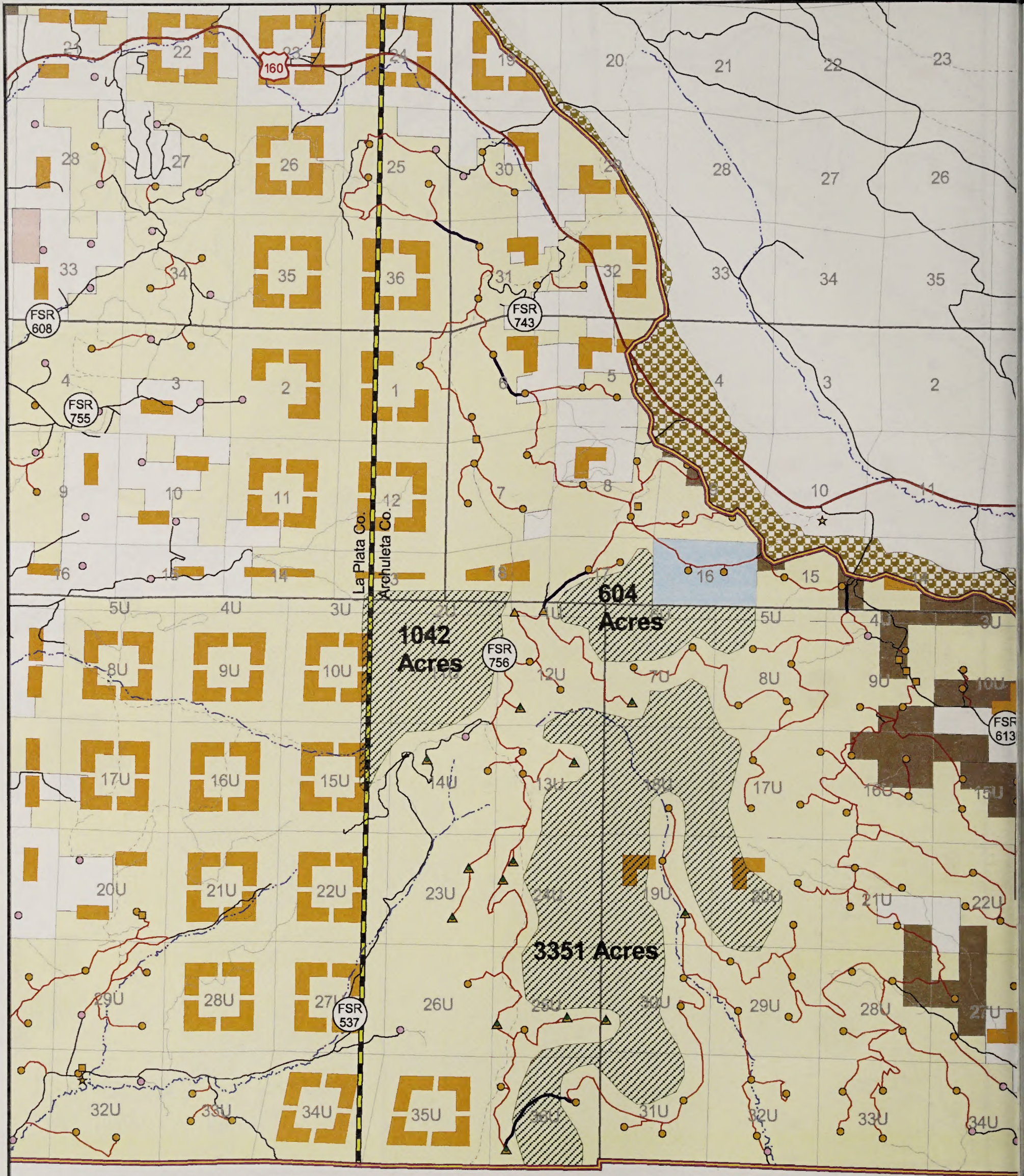
NORTHERN SAN JUAN BASIN CBM EIS

FIGURE 3-44
ALTERNATIVE 1B
PROJECTED ROADLESS AREA

ANALYSIS AREA: LA PLATA & ARCHULETA COUNTIES, COLORADO

Date: 04/01/04 | ArcView File: C:\994-sanjuan\roadless.apr

Prepared By: JG



Legend

- Existing Well
- Proposed Well - Known Location
- Proposed Well - General Location
- Proposed Disposal Well
- Existing Disposal Well
- Existing Compressor
- Proposed Compressor
- Proposed Directional Drill Well Pad
- Proposed Directional Drill Well Pad With Well
- Proposed Access Road/Flowline
- Proposed Flowline
- Project Area Boundary
- U.S. Highway
- Primary Road
- Secondary Road
- River/Stream

Surface Ownership/Mineral Ownership

- Federal/Federal
- Federal/Private
- Private/Private
- Private/Federal
- State/State
- Projected Roadless Area
- Fruitland Outcrop

Transverse Mercator Projection
1927 North American Datum
Zone 13

0 1 2 Miles

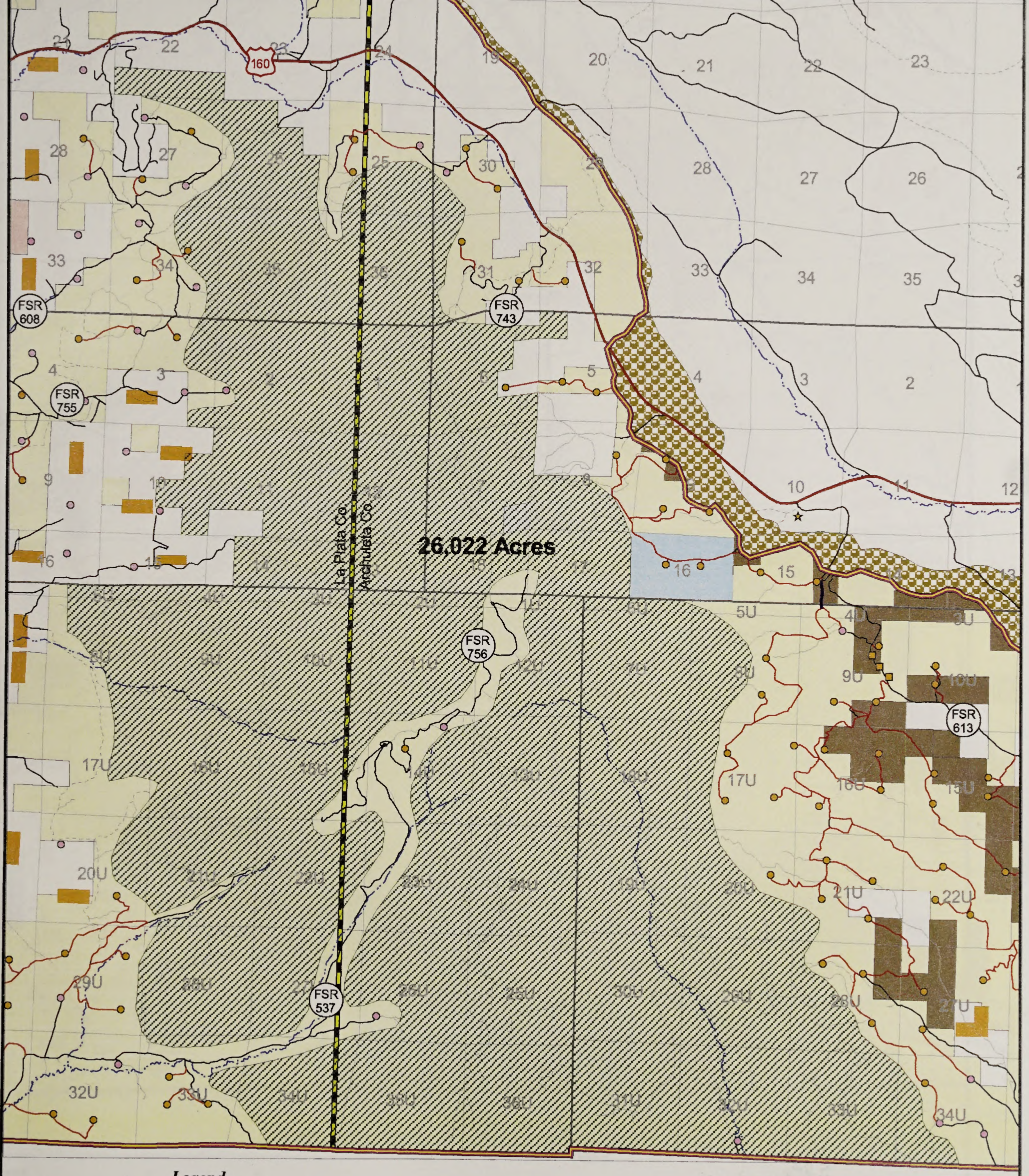
NORTHERN SAN JUAN BASIN CBM EIS

FIGURE 3-45
ALTERNATIVE 2
PROJECTED ROADLESS AREA

ANALYSIS AREA: LA PLATA & ARCHULETA COUNTIES, COLORADO

Date: 04/01/04 | ArcView File: C:\994-sanjuan\roadless.a

Prepared By: JG



Legend

- Existing Well
- Proposed Well - Known Location
- Proposed Well - General Location
- Proposed Disposal Well
- Existing Disposal Well
- Existing Compressor
- Proposed Compressor
- Proposed Access Road/Flowline
- Project Area Boundary
- U.S. Highway
- Primary Road
- Secondary Road
- River/Stream

Surface Ownership/Mineral Ownership

- Federal/Federal
- Federal/Private
- Private/Private
- Private/Federal
- State/State
- Projected Roadless Area
- Fruitland Outcrop

Transverse Mercator Projection
1927 North American Datum
Zone 13

0 1 2 Miles

NORTHERN SAN JUAN BASIN CBM EIS

FIGURE 3-46
ALTERNATIVE 3
PROJECTED ROADLESS AREA

ANALYSIS AREA: LA PLATA & ARCHULETA COUNTIES, COLORADO

Date: 04/01/04

ArcView File: C:\994-sanjuan\roadless.apr

Prepared By: JG

1770 Acres

12,410 Acres

La Plata Co.

Archuleta Co.

FSR 608

FSR 755

FSR 743

FSR 756

FSR 537

Legend

- Existing Well
- Proposed Well - Known Location
- Proposed Well - General Location
- Proposed Disposal Well
- Existing Disposal Well
- Existing Compressor
- Proposed Compressor
- Proposed Access Road/Flowline
- Project Area Boundary
- U.S. Highway
- Primary Road
- Secondary Road
- River/Stream

Surface Ownership/Mineral Ownership

- Federal/Federal
- Federal/Private
- Private/Private
- Private/Federal
- State/State
- Projected Roadless Area
- Fruitland Outcrop

Transverse Mercator Projection
1927 North American Datum
Zone 13

0 1 2 Miles

NORTHERN SAN JUAN BASIN CBM EIS

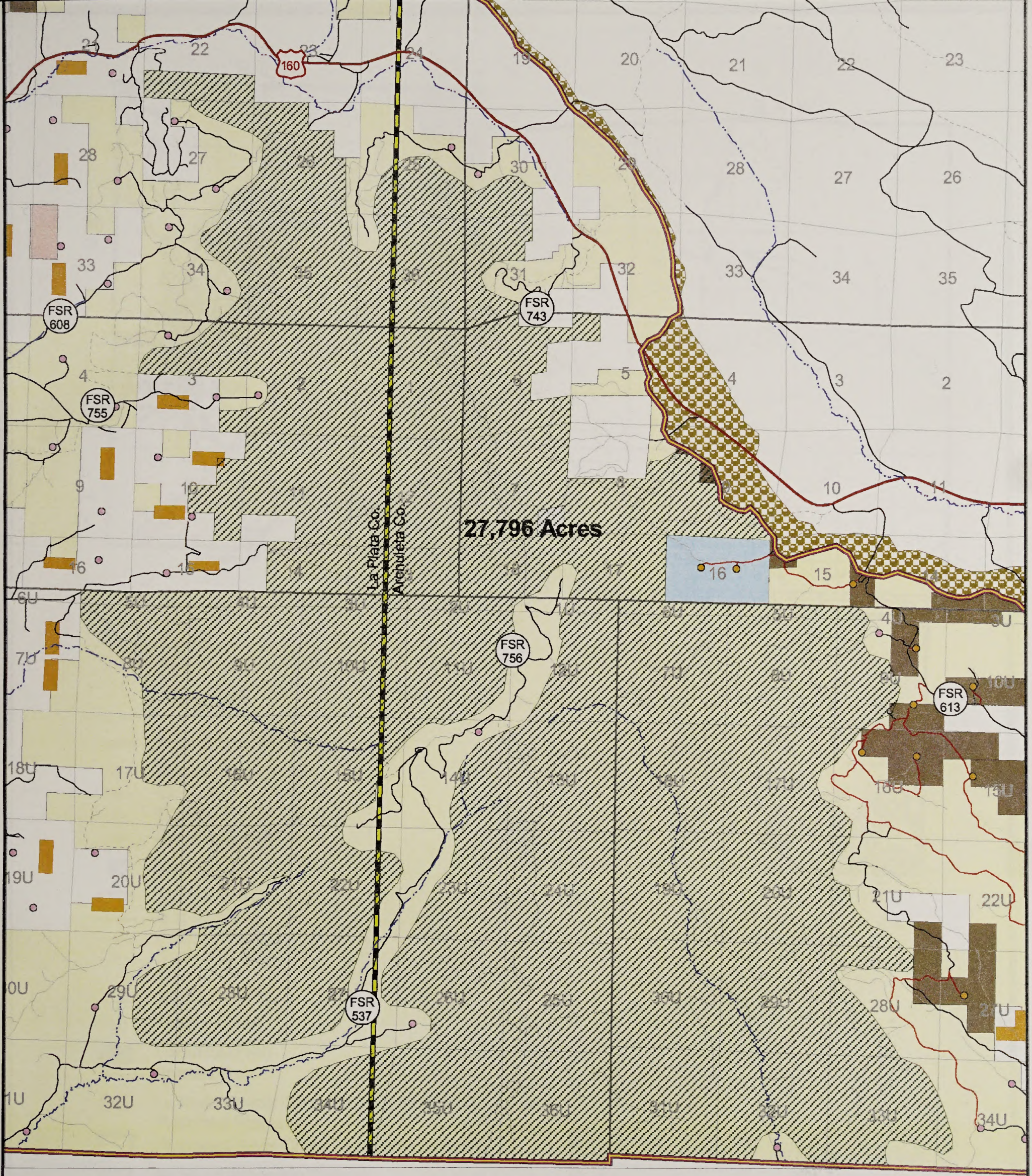
FIGURE 3-47
ALTERNATIVE 4
PROJECTED ROADLESS AREA

ANALYSIS AREA: LA PLATA & ARCHULETA COUNTIES, COLORADO

Date: 04/01/04

ArcView File: C:\994-sanjuan\roadless.a

Prepared By: JG



Legend

- Existing Well
- Proposed Well - Known Location
- Proposed Well - General Location
- Proposed Disposal Well
- Existing Disposal Well
- Existing Compressor
- Proposed Compressor
- Proposed Access Road/Flowline
- Project Area Boundary

- U.S. Highway
- Primary Road
- Secondary Road
- River/Stream

Surface Ownership/Mineral Ownership

- Federal/Federal
- Federal/Private
- Private/Private
- Private/Federal
- State/State
- Projected Roadless Area
- Fruitland Outcrop

Transverse Mercator Projection
1927 North American Datum
Zone 13

0 1 2 Miles

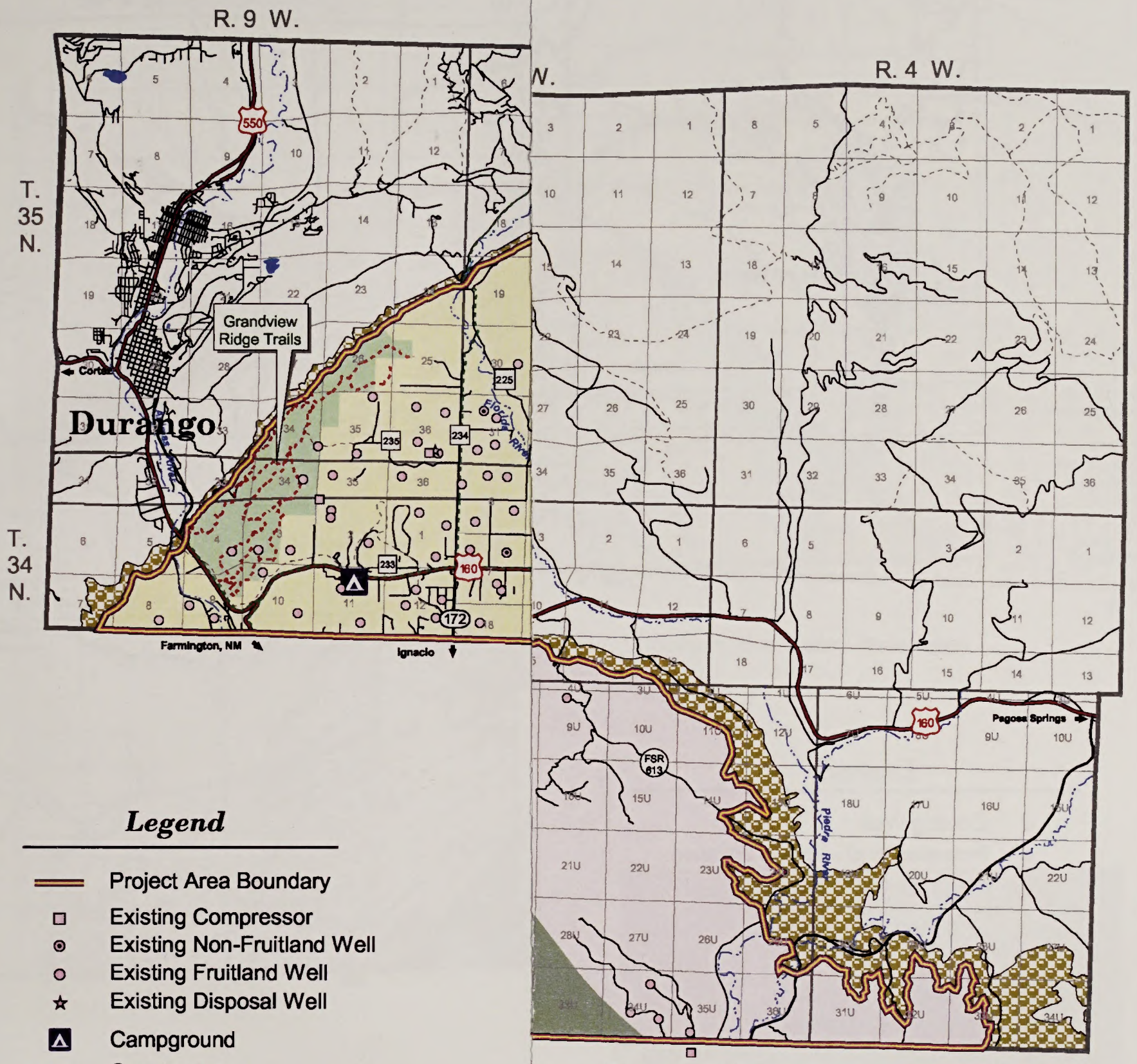
NORTHERN SAN JUAN BASIN CBM EIS

FIGURE 3-48
ALTERNATIVE 5
PROJECTED ROADLESS AREA

ANALYSIS AREA: LA PLATA & ARCHULETA COUNTIES, COLORADO

Date: 04/01/04 | ArcView File: C:\994-sanjuan\roadless.apr

Prepared By: JG



Legend

- Project Area Boundary
- Existing Compressor
- Existing Non-Fruitland Well
- Existing Fruitland Well
- Existing Disposal Well
- Campground
- County Line
- U.S. Highway
- Primary Road
- Secondary Road
- Trail
- Recreation Trail
- Bicycle Route
- Lake/Reservoir
- Stream/River
- La Plata County Open Space Conservancy Protected Property
- Proposed Sauls Creek Trail System Bounda
- Fruitland Formation Outcrop

Recreation Areas

- BLM - FS Dispersed Lands
- Fosset Gulch
- Grandview Ridge
- HD Mountains Roadless Area
- Sauls Creek
- Spring Creek

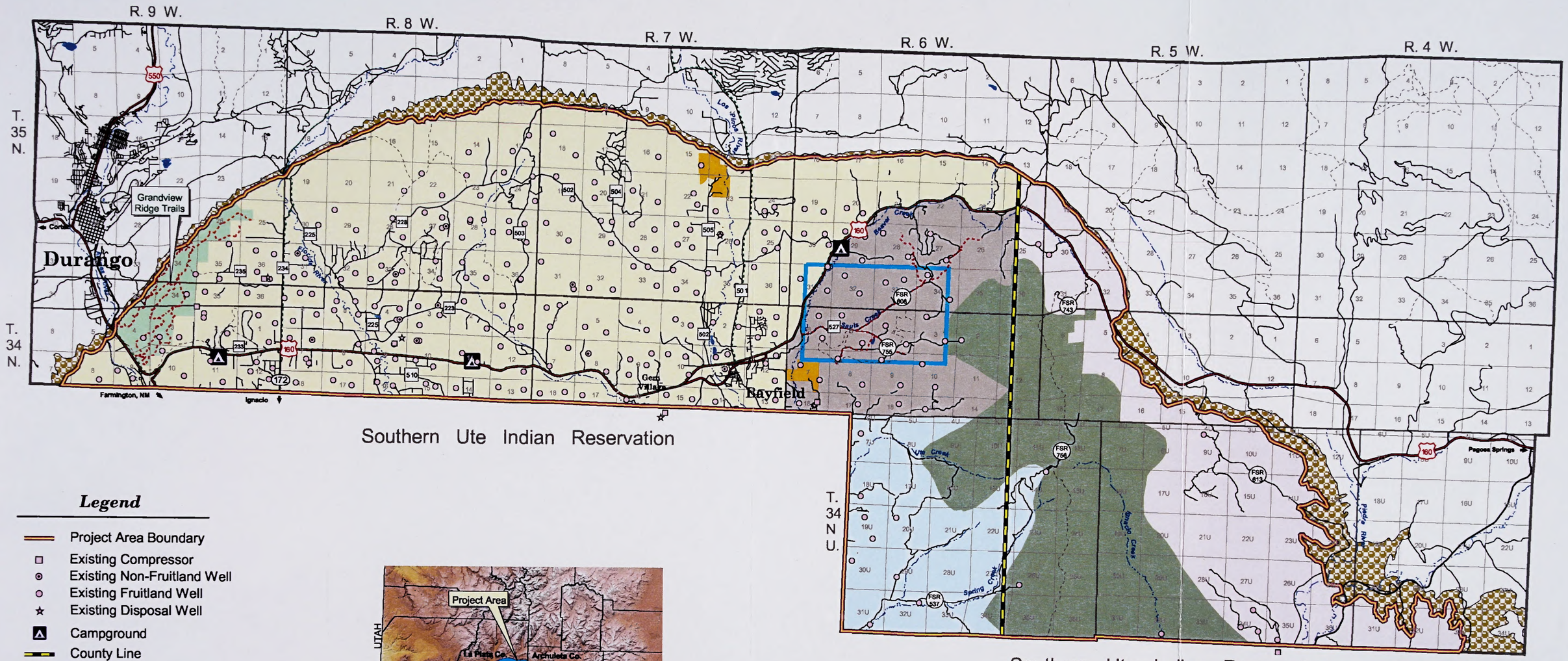
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udy, 1998.
ortation

well
SFS.
.

n

ian Reservation

NORTHERN SAN JUAN BASIN CBM EIS	
FIGURE 3-49 RECREATION	
ANALYSIS AREA: LA PLATA & ARCHULETA COUNTIES, COLORADO	
Date: 04/01/04	ArcView File: C:\894-sanjuan\proj1.apr
	Prepared By: JG

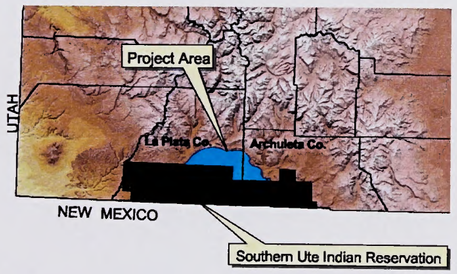


Legend

- Project Area Boundary
- Existing Compressor
- Existing Non-Fruitland Well
- Existing Fruitland Well
- Existing Disposal Well
- Campground
- County Line
- U.S. Highway
- Primary Road
- Secondary Road
- Trail
- Recreation Trail
- Bicycle Route
- Lake/Reservoir
- Stream/River
- La Plata County Open Space Conservancy Protected Property
- Proposed Sauls Creek Trail System Boundary
- Fruitland Formation Outcrop

Recreation Areas

- BLM - FS Dispersed Lands
- Fosset Gulch
- Grandview Ridge
- HD Mountains Roadless Area
- Sauls Creek
- Spring Creek



2 0 2 4 6 8 *Kilometers*

2 0 2 4 6 8 *Miles*

La Plata County transportation data provided by the La Plata County Transportation Study, 1998. Hydrologic and Archuleta County transportation features extracted from 1:100,000 USGS SDTS data. Existing wells extracted from COGCC well database and edited by the BLM & USFS. ROS classes provided by the USFS.

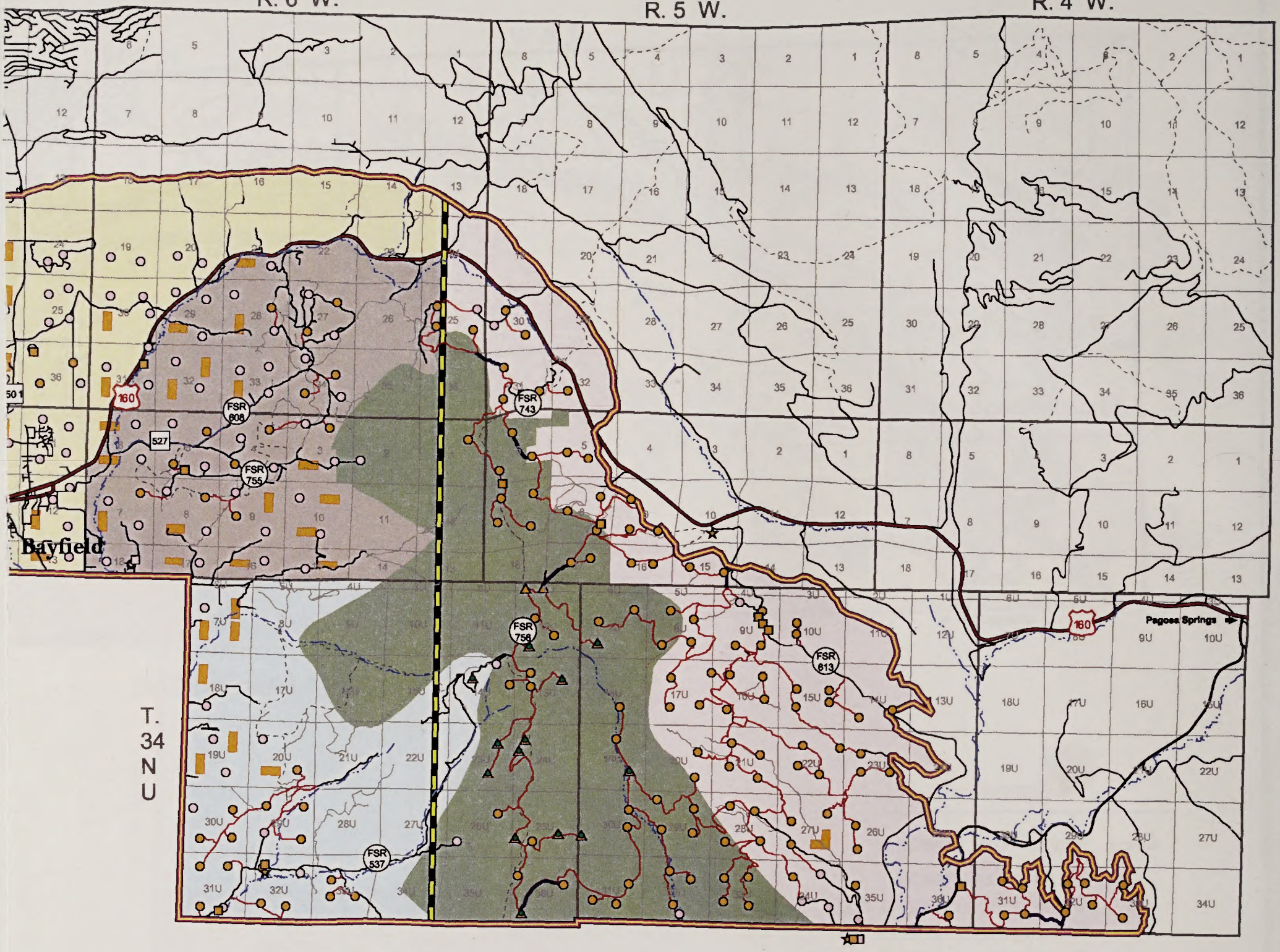
Transverse Mercator Projection
1927 North American Datum
Zone 13

NORTHERN SAN JUAN BASIN CBM EIS

FIGURE 3-49
RECREATION

ANALYSIS AREA: LA PLATA & ARCHULETA COUNTIES, COLORADO

Date: 04/01/04	ArcView File: C:\994-san\juan\proj1.apr
	Prepared By: JG



La Plata County transportation data provided by the La Plata County Transportation Study, 1998. Hydrologic and Archuleta County transportation features extracted from 1:100,000 USGS SDTS data. Existing wells extracted from COGCC well database and edited by the BLM & USFS.

Kilometers

6 8 Miles

Transverse Mercator Projection
1927 North American Datum
Zone 13

NORTHERN SAN JUAN BASIN CBM EIS

FIGURE 3-50
RECREATION AREAS & COMPANIES' PROPOSED ACTION

ANALYSIS AREA: LA PLATA & ARCHULETA COUNTIES, COLORADO

Date: 04/01/04	ArcView File: C:\994-sanjuan\proposal.apr
	Prepared By: JG

Existing Road System And Travel Management Area

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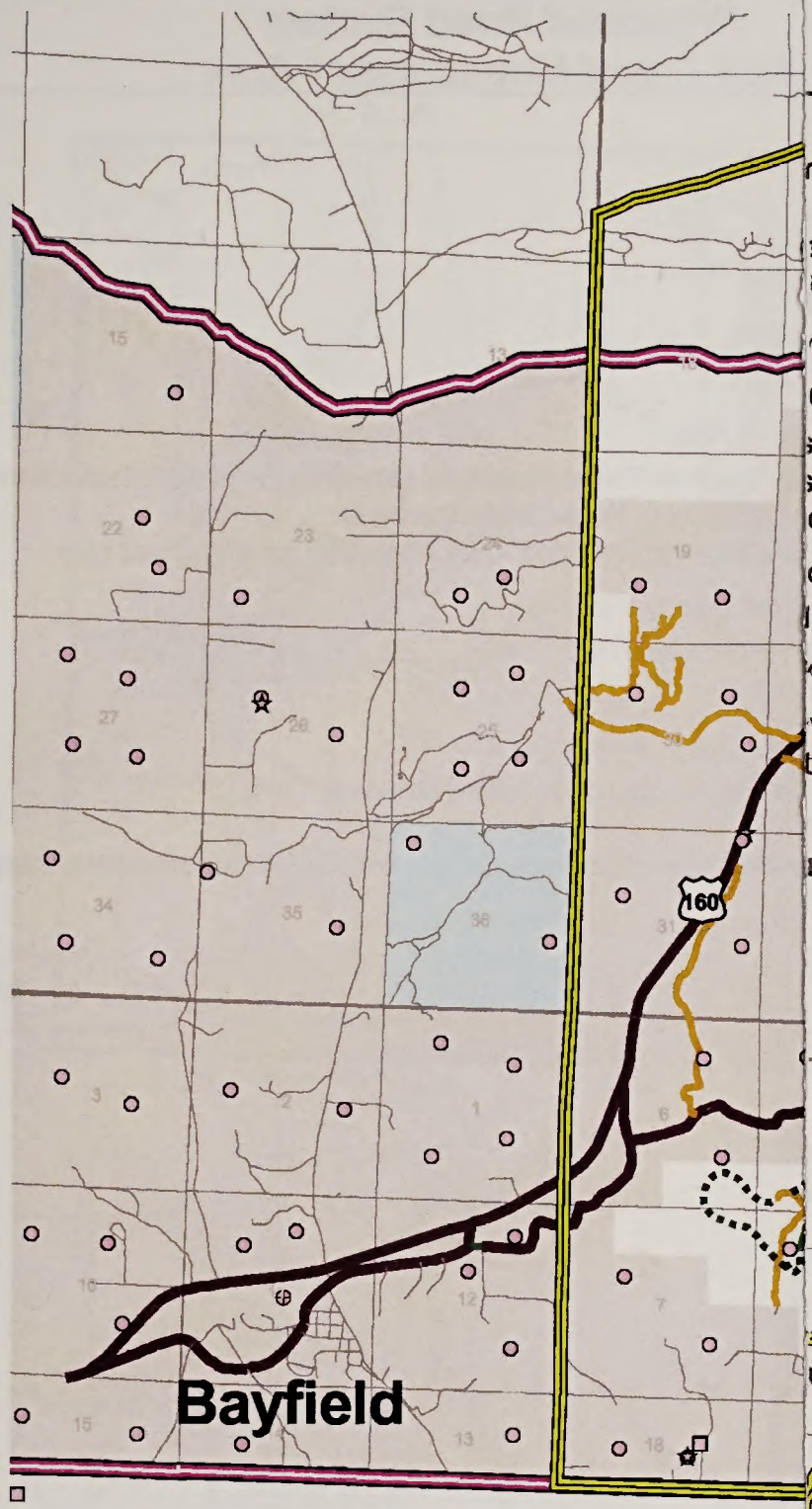
County Road

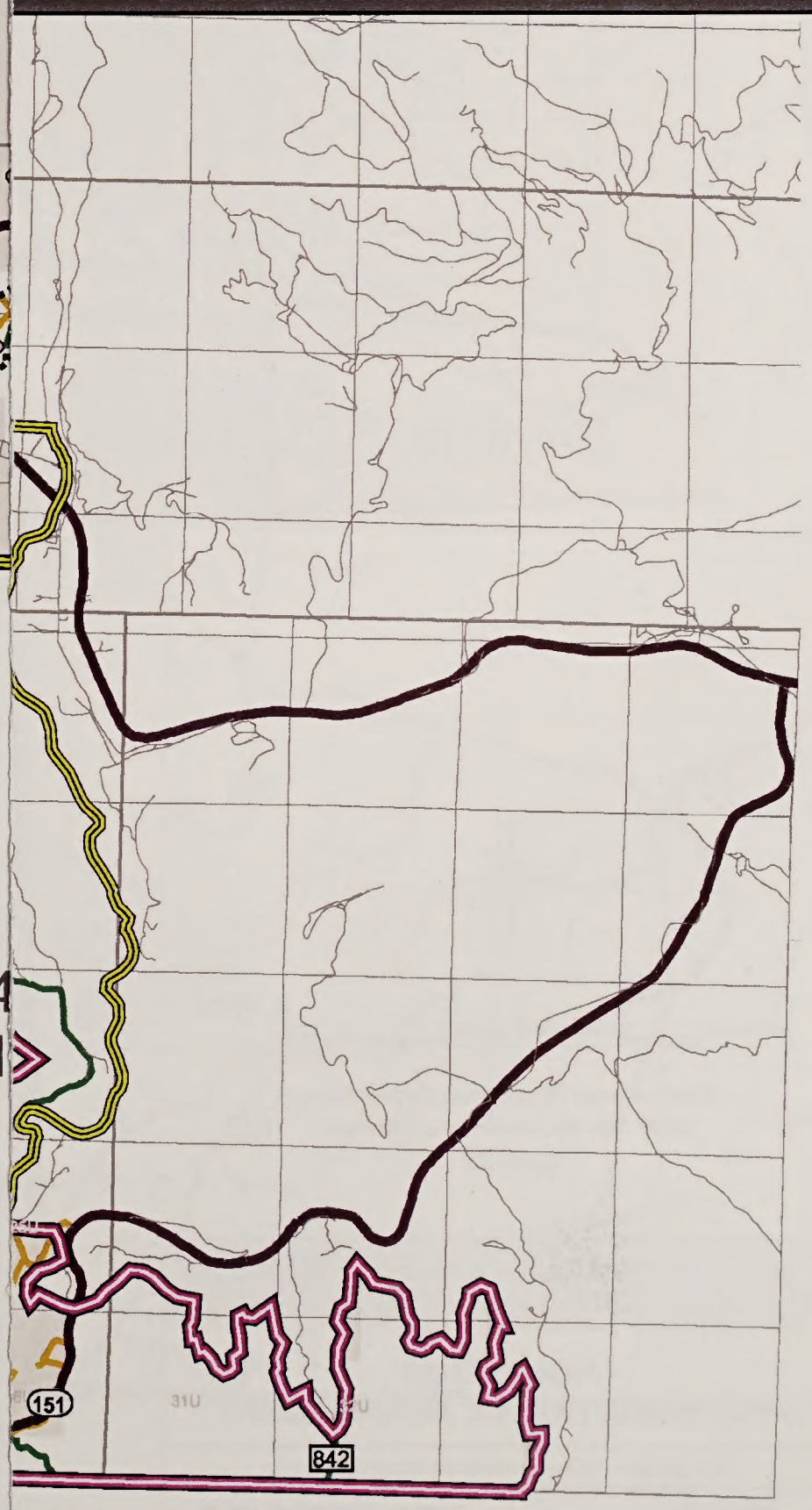
sified Open to Public Motorized Use With Seasonal Restrictions
sified Closed to Public Motorized Use
d or USFS Unclassified - Not Approved for Motorized Use

o Public Motorized Use
l to Public Motorized Use

Analysis

vel Management Area C -
to OHV Use With Seasonal Restrictions





N
W
E
S

1 0 1 2 Miles

T. 34 N.

Transverse Mercator Projection
1927 North American Datum
Zone 13

NORTHERN SAN JUAN BASIN CBM PROJECT
ROADS ANALYSIS

FIGURE 3-51
EXISTING TRAVEL MANAGEMENT

ANALYSIS AREA: LA PLATA & ARCHULETA COUNTIES, COLORADO

Date: 04/01/04	ArcView File: C:\994-sanjuan\fs_roads.apr
	Prepared By: JG

R. 9 W. R. 8 W. R. 7 W. R. 6 W. R. 5 W. R. 4 W.

T. 35 N.

T. 34 N.

T. 34 N U

Durango

Bayfield

Farmington, NM

Ignacio

Pagosa Springs

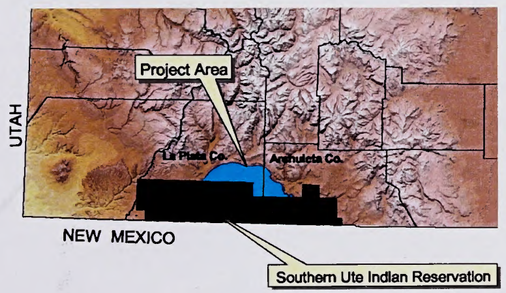
Southern Ute Indian Reservation

Legend

- Existing Well
- Proposed Well - Known Location
- Proposed Well - General Location
- Proposed Disposal Well
- Existing Disposal Well
- Existing Compressor
- Proposed Compressor
- Proposed Directional Drill Well Pad
- Proposed Directional Drill Well Pad With Well
- Proposed Flowline
- Proposed Access Road/Flowline
- Project Area Boundary
- U.S. Highway
- Primary Road
- Secondary Road
- Closed USFS Road
- Trail
- River/Stream

Recreation Areas

- BLM - FS Dispersed Lands
- Fosset Gulch
- Grandview Ridge
- HD Mountains Roadless Area
- Sauls Creek
- Spring Creek
- Fruitland Outcrop



2 0 2 4 6 8 *Kilometers*

2 0 2 4 6 8 *Miles*

La Plata County transportation data provided by the La Plata County Transportation Study, 1998. Hydrologic and Archuleta County transportation features extracted from 1:100,000 USGS SDTS data. Existing wells extracted from COGCC well database and edited by the BLM & USFS.

Transverse Mercator Projection
1927 North American Datum
Zone 13

NORTHERN SAN JUAN BASIN CBM EIS

FIGURE 3-50
RECREATION AREAS & COMPANIES' PROPOSED ACTION

ANALYSIS AREA: LA PLATA & ARCHULETA COUNTIES, COLORADO

Date: 04/01/04	ArcView File: C:\994-sanjuan\proposal.apr
	Prepared By: JG

Existing Road System And Travel Management Area

Existing Facilities
- Compressor
- Disposal
- Fruitland Well
- Non-Fruitland Well

- Project Boundary
- Highway or County Road
- USFS Classified Open to Public Motorized Use With Seasonal Restrictions
- USFS Classified Closed to Public Motorized Use
- Private Road or USFS Unclassified - Not Approved for Motorized Use
- Trail Open to Public Motorized Use
- Trail Closed to Public Motorized Use
- Outside of Analysis
- Existing Travel Management Area C - Area Open to OHV Use With Seasonal Restrictions

R. 6 W.

R. 5 W.

T. 34 N

Bayfield

135 131 132 160 608B 608 755 743 160 756 610 126 537 123 537 613 841 615 615A 613 151 842

N W E S

1 0 1 2 Miles

Transverse Mercator Projection
1927 North American Datum
Zone 13

NORTHERN SAN JUAN BASIN CBM PROJECT
ROADS ANALYSIS

FIGURE 3-51
EXISTING TRAVEL MANAGEMENT

ANALYSIS AREA: LA PLATA & ARCHULETA COUNTIES, COLORADO

Date: 04/01/04	ArcView File: C:\994-sanjuan\fs_roads.apr
	Prepared By: JG

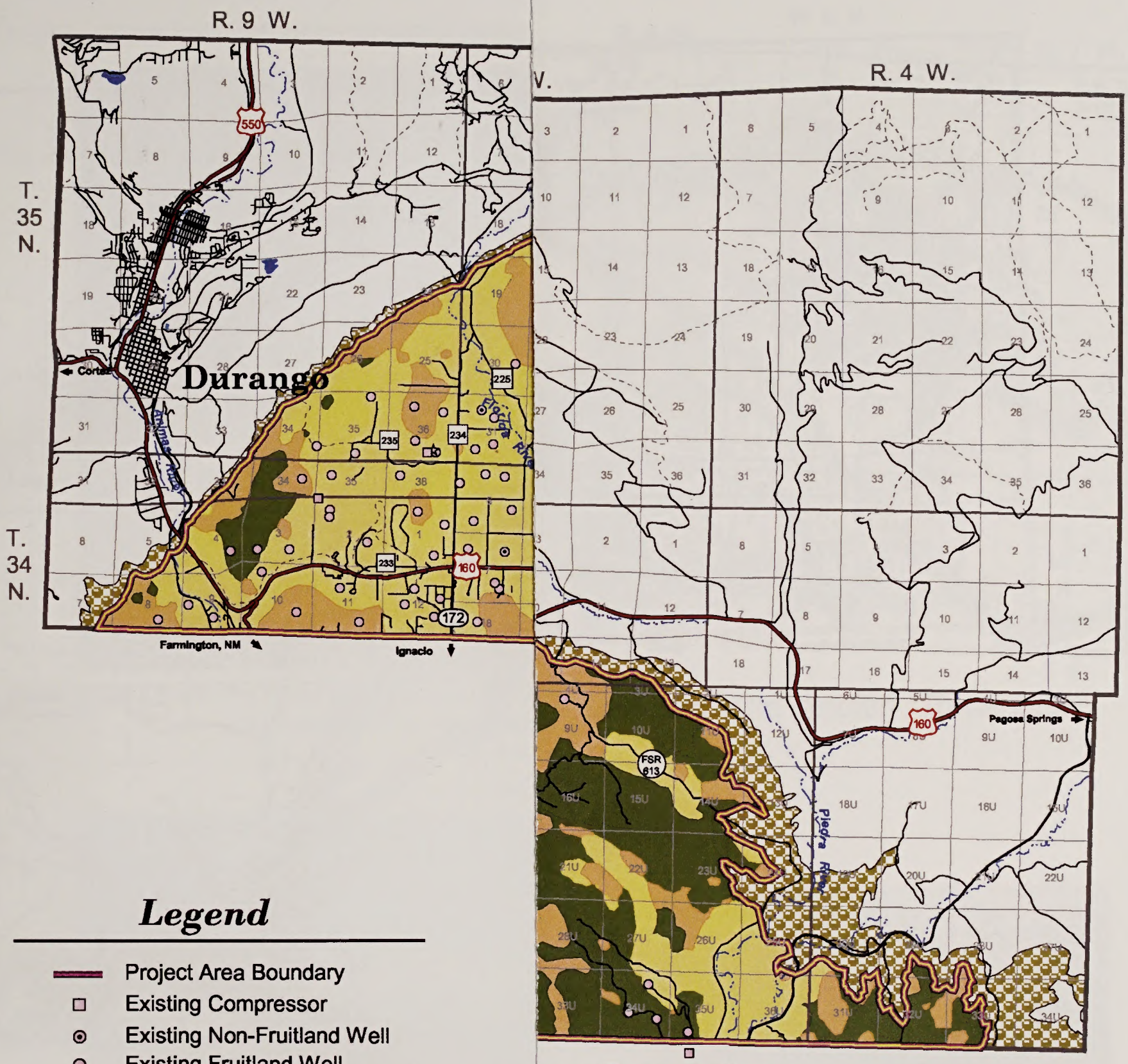
Proposed Road System And Travel Management Area

Existing Facilities

- Compressor
- Disposal
- Fruitland Well
- Non-Fruitland Well
- Proposed Well Pad
- Project Boundary
- Highway or County Road
- USFS Classified Open to Public Motorized Use With Seasonal Restrictions
- USFS Classified Closed to Public Motorized Use
- Private Road or USFS Unclassified - Not Approved for Motorized Use
- Trail Open to Public Motorized Use
- Trail Closed to Public Motorized Use
- Outside of Analysis
- Proposed Travel Management Area A - Motorized Travel Restricted to Classified Roads & Trails

R. 5 W.

160
613
841
615
615A
613
151
842



Legend

- Project Area Boundary
- Existing Compressor
- Existing Non-Fruitland Well
- Existing Fruitland Well
- Existing Disposal Well
- County Line
- U.S. Highway
- Primary Road
- Secondary Road
- Trail
- Lake/Reservoir
- Stream/River
- Fruitland Formation Outcrop

Visual Quality Objectives

- Modification
- Partial Retention
- Retention

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NORTHERN SAN JUAN BASIN CBM EIS	
FIGURE 3-53 **VISUAL QUALITY OBJECTIVE**	
ANALYSIS AREA: LA PLATA & ARCHULETA COUNTIES, COLORADO	
Date: 04/01/04	ArcView File: C:\994-sanjuan\proj1.apr
	Prepared By: JG

Proposed Road System And Travel Management Area

Existing Facilities
- Compressor
- Disposal
- Fruitland Well
- Non-Fruitland Well

- Proposed Well Pad
- Project Boundary
- Highway or County Road
- USFS Classified Open to Public Motorized Use With Seasonal Restrictions
- USFS Classified Closed to Public Motorized Use
- Private Road or USFS Unclassified - Not Approved for Motorized Use
- Trail Open to Public Motorized Use
- Trail Closed to Public Motorized Use
- Outside of Analysis
- Proposed Travel Management Area A - Motorized Travel Restricted to Classified Roads & Trails

R. 6 W.

R. 5 W.

T. 34 N

Bayfield

135 132 131 160 608B 608 743 755 501 160 756 610 613 126 841 537 123 615 615A 613 151 842 537

N W E S

1 0 1 2 Miles

Transverse Mercator Projection
1927 North American Datum
Zone 13

NORTHERN SAN JUAN BASIN CBM PROJECT
ROADS ANALYSIS

FIGURE 3-52
PROPOSED TRAVEL MANAGEMENT

ANALYSIS AREA: LA PLATA & ARCHULETA COUNTIES, COLORADO	
Date: 04/01/04	ArcView File: C:\994-sanjuan\fs_roads.apr
	Prepared By: JG

R. 9 W. R. 8 W. R. 7 W. R. 6 W. R. 5 W. R. 4 W.

T. 35 N.

T. 34 N.

Durango

Bayfield

Gem Village

Pagosa Springs

Farmington, NM

Ignacio

Southern Ute Indian Reservation

T. 34 N U.

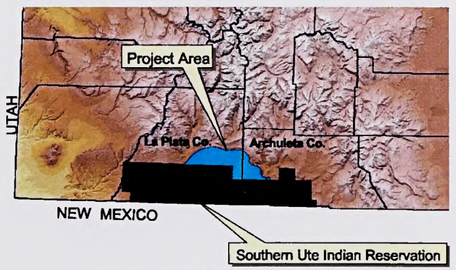
Southern Ute Indian Reservation

Legend

- Project Area Boundary
- Existing Compressor
- Existing Non-Fruitland Well
- Existing Fruitland Well
- Existing Disposal Well
- County Line
- U.S. Highway
- Primary Road
- Secondary Road
- Trail
- Lake/Reservoir
- Stream/River
- Fruitland Formation Outcrop

Visual Quality Objectives

- Modification
- Partial Retention
- Retention



N W E S

2 0 2 4 6 8 Kilometers

2 0 2 4 6 8 Miles

La Plata County transportation data provided by the La Plata County Transportation Study, 1998. Hydrologic and Archuleta County transportation features extracted from 1:100,000 USGS SDTS data.
Existing wells extracted from COGCC well database and edited by BLM & USFS.
Visual quality data provided by the USFS.

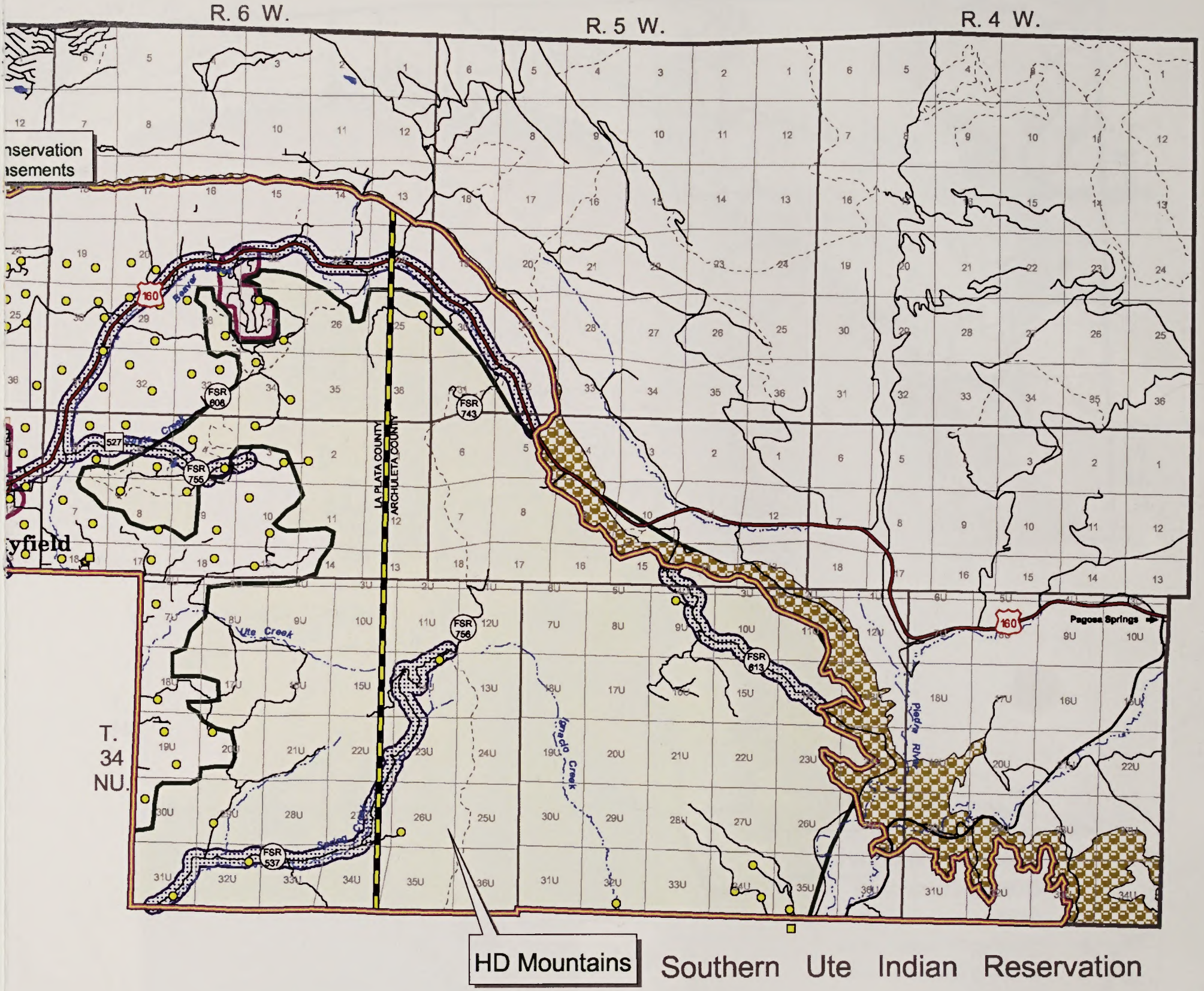
Transverse Mercator Projection
1927 North American Datum
Zone 13

NORTHERN SAN JUAN BASIN CBM EIS

FIGURE 3-53
VISUAL QUALITY OBJECTIVE

ANALYSIS AREA: LA PLATA & ARCHULETA COUNTIES, COLORADO

Date: 04/01/04	ArcView File: C:\1994-sanjuan\proj1.apr
	Prepared By: JG



La Plata County transportation data provided by the La Plata County Transportation Study, 1998. Hydrologic and Archuleta County transportation features extracted from 1:100,000 USGS SDTS data.
Existing wells extracted from COGCC well database.
Land use categories developed through discussions with the BLM and USFS.

Transverse Mercator Projection
1927 North American Datum
Zone 13

eters

8 Miles

NORTHERN SAN JUAN BASIN CBM EIS

FIGURE 3-54
REPRESENTATIVE RECEPTORS FOR VISUALS & NOISE ANALYSIS

ANALYSIS AREA: LA PLATA & ARCHULETA COUNTIES, COLORADO	
Date: 04/01/04	ArcView File: C:\994-sanjuan\proj1.apr
	Prepared By: JG

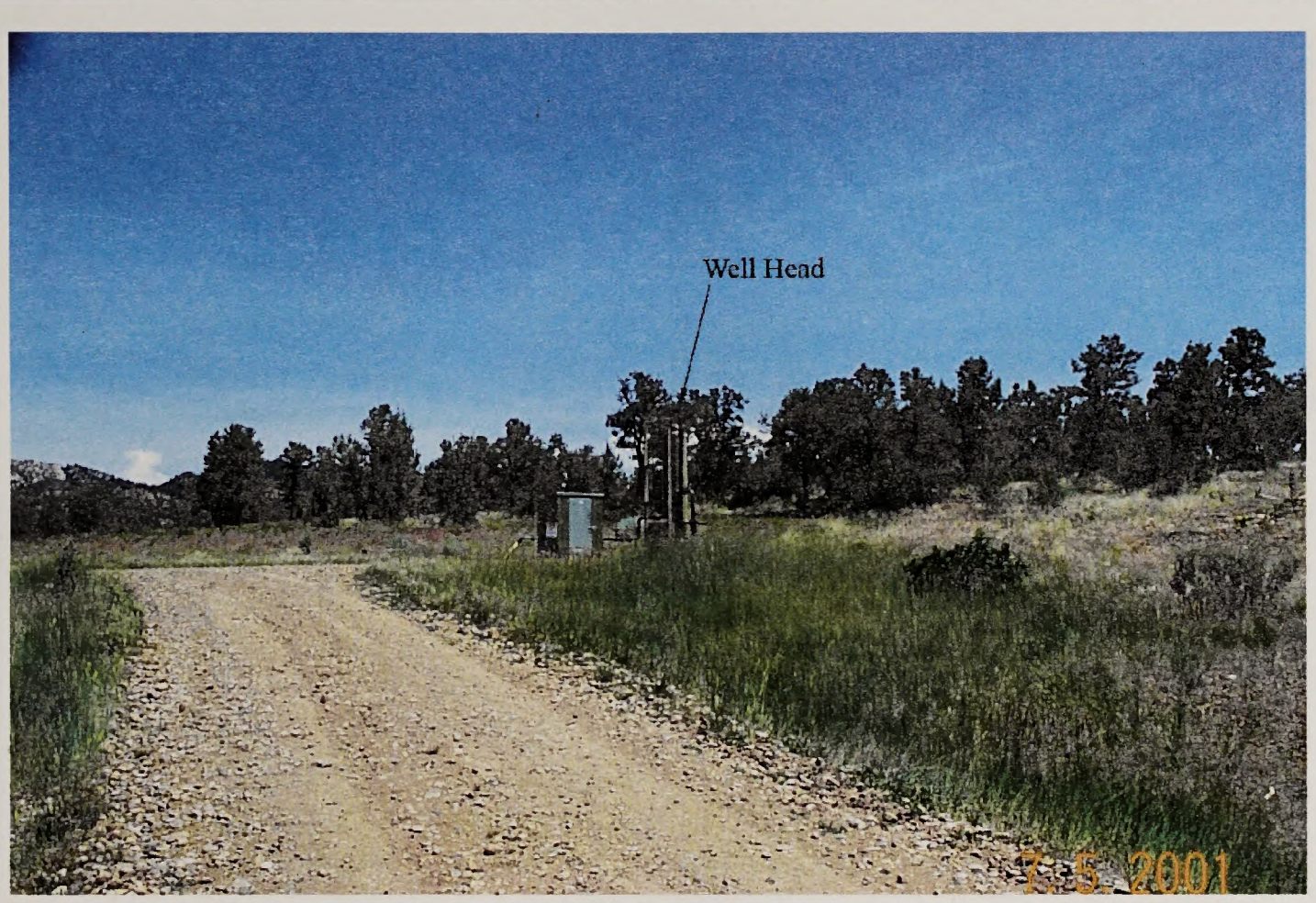
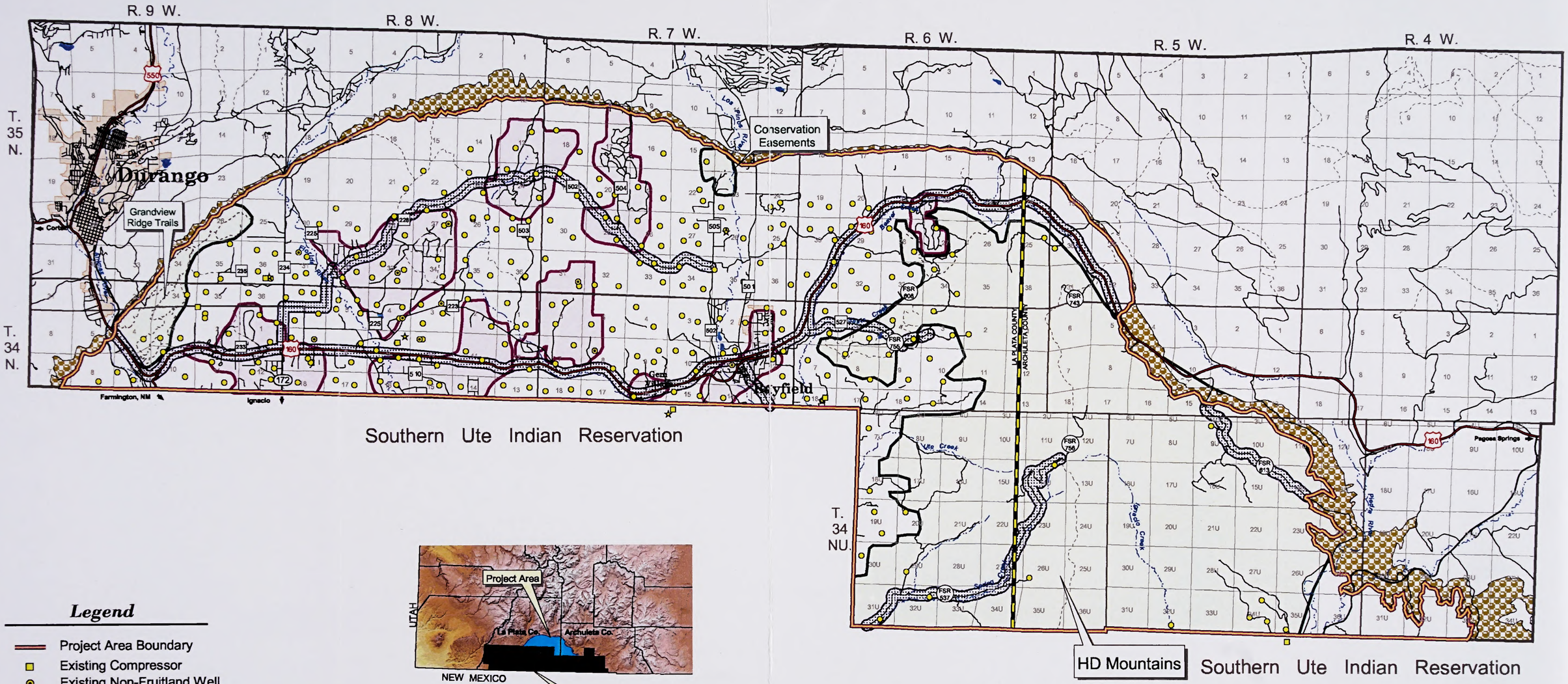
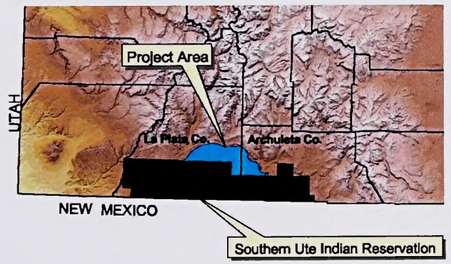


Figure 3–55 A View 150 feet west of a Well Head (foreground view) in a High Use Recreation Area (Grandview Ridge Trails Area)



Figure 3–56 A View 150 feet south of a Well Head (foreground view) in a High Use Recreation Area (Grandview Ridge Trails Area)



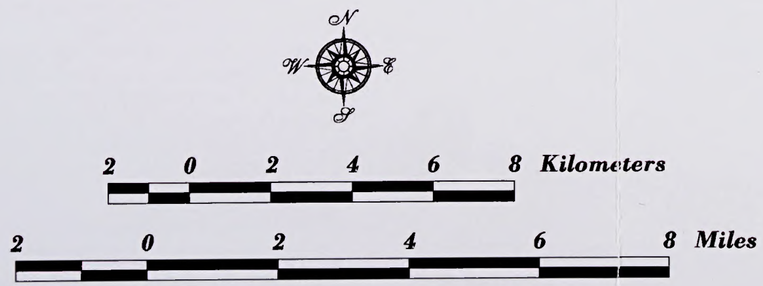


Legend

- Project Area Boundary
- Existing Compressor
- Existing Non-Fruitland Well
- Existing Fruitland Well
- Existing Disposal Well
- County Line
- U.S. Highway
- Primary Road
- Secondary Road
- Trail
- Lake/Reservoir
- Stream/River
- Municipal Area
- Fruitland Formation Outcrop

Primary Viewing Areas

- Transportation Corridor
- Residential Land Use
- Recreation/Open Area



La Plata County transportation data provided by the La Plata County Transportation Study, 1998. Hydrologic and Archuleta County transportation features extracted from 1:100,000 USGS SDTS data. Existing wells extracted from COGCC well database. Land use categories developed through discussions with the BLM and USFS.

Transverse Mercator Projection
1927 North American Datum
Zone 13

NORTHERN SAN JUAN BASIN CBM EIS

FIGURE 3-54
REPRESENTATIVE RECEPTORS FOR VISUALS & NOISE ANALYSIS

ANALYSIS AREA: LA PLATA & ARCHULETA COUNTIES, COLORADO

Date: 04/01/04	ArcView File: C:\994-sanjuan\proj1.apr
	Prepared By: JG



Figure 3–55 A View 150 feet west of a Well Head (foreground view) in a High Use Recreation Area (Grandview Ridge Trails Area)



Figure 3–56 A View 150 feet south of a Well Head (foreground view) in a High Use Recreation Area (Grandview Ridge Trails Area)

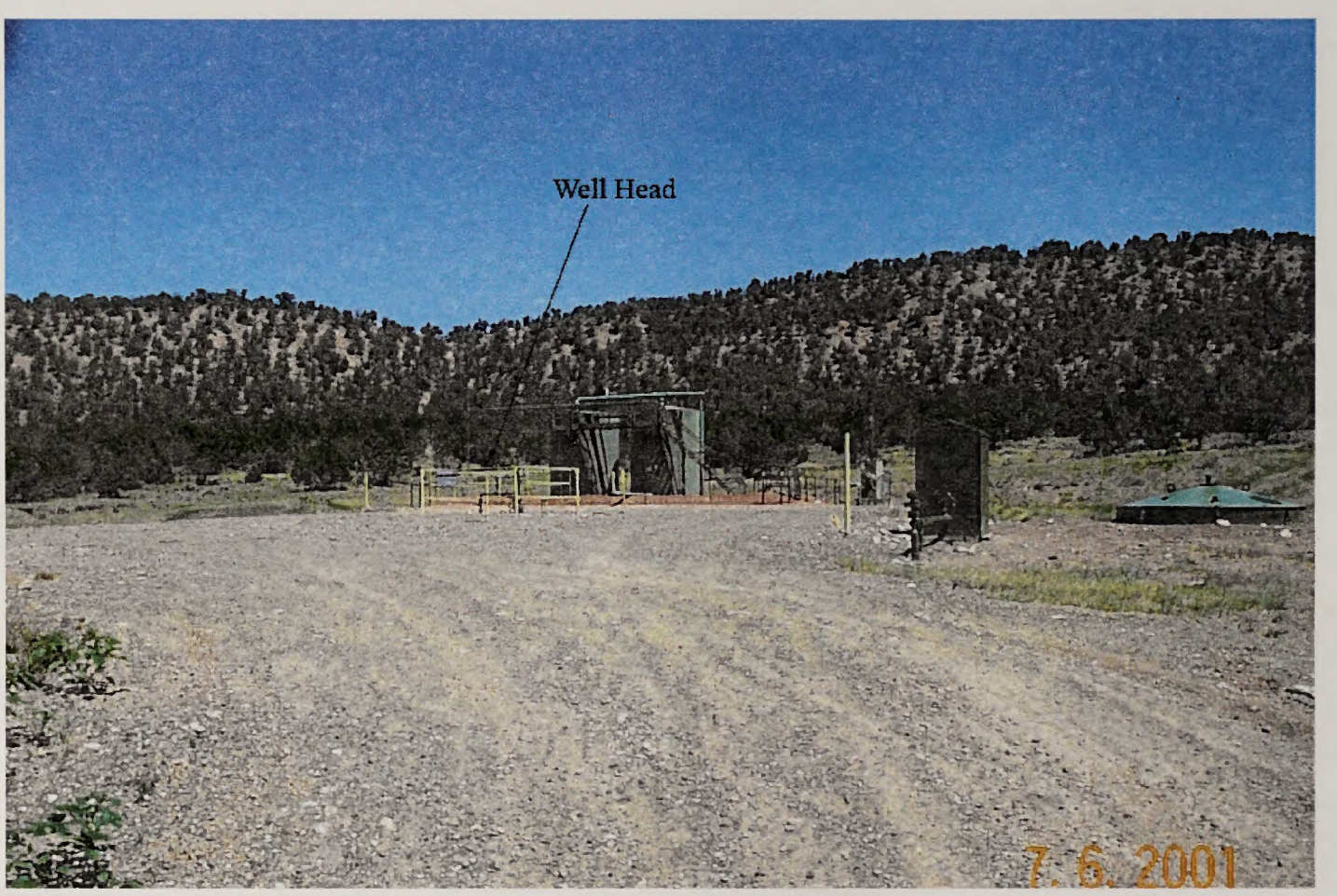


Figure 3–57 **A View 150 feet from a Well Head (foreground view) in a Low Use Recreation Area (HD Mountains)**



Figure 3–58 **A View 150 feet from a Pump Jack (foreground view), along a Collector Road (La Plata County Road 228)**



Figure 3–59 **A View Approximately 150 feet (foreground view) from a Well Head along a Major Transportation Arterial (Highway 160)**

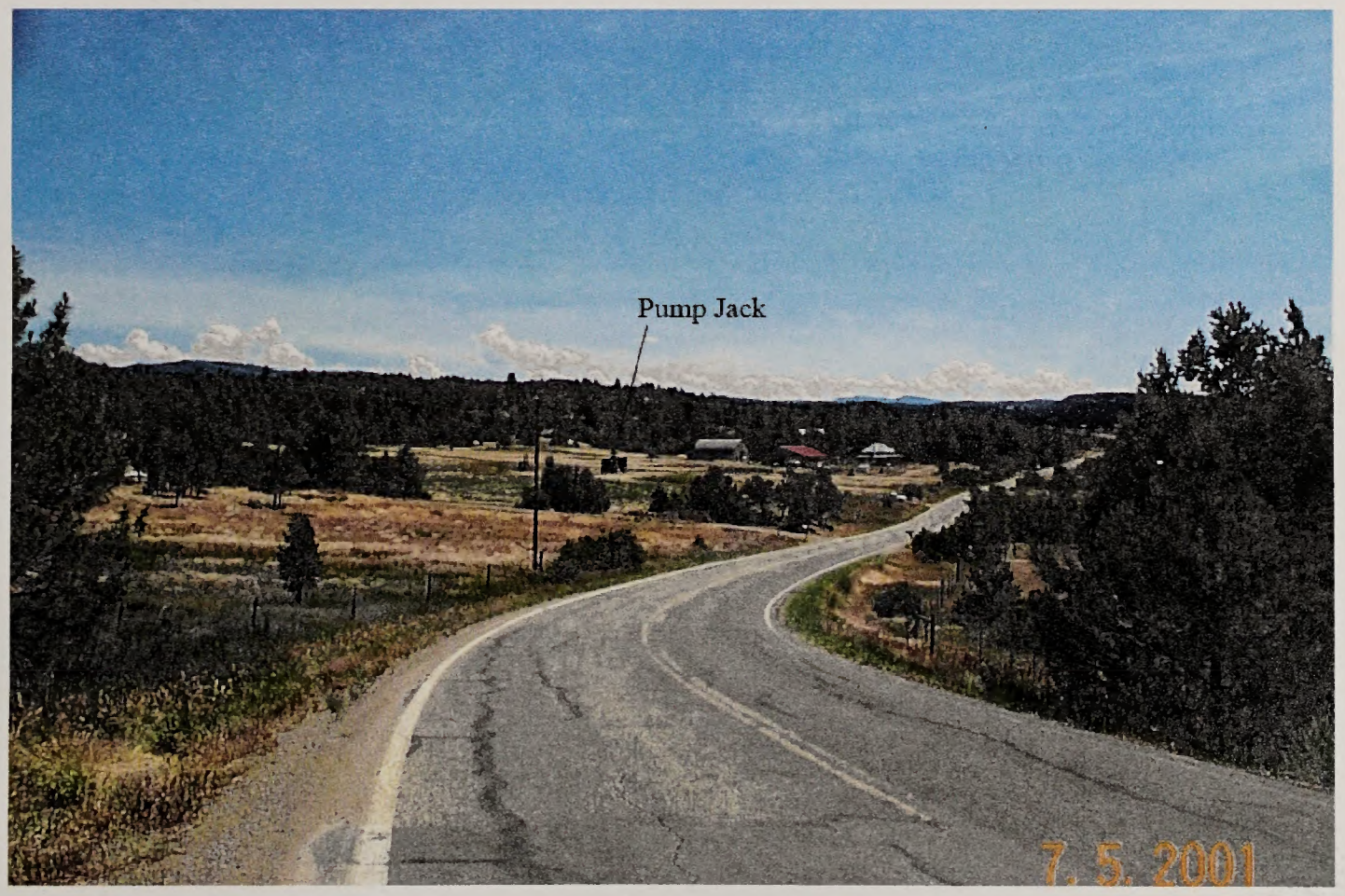


Figure 3–60 **A View Less than 0.5 mile from a Pump Jack (foreground view) along a Collector Road (north side of La Plata County Road 228)**

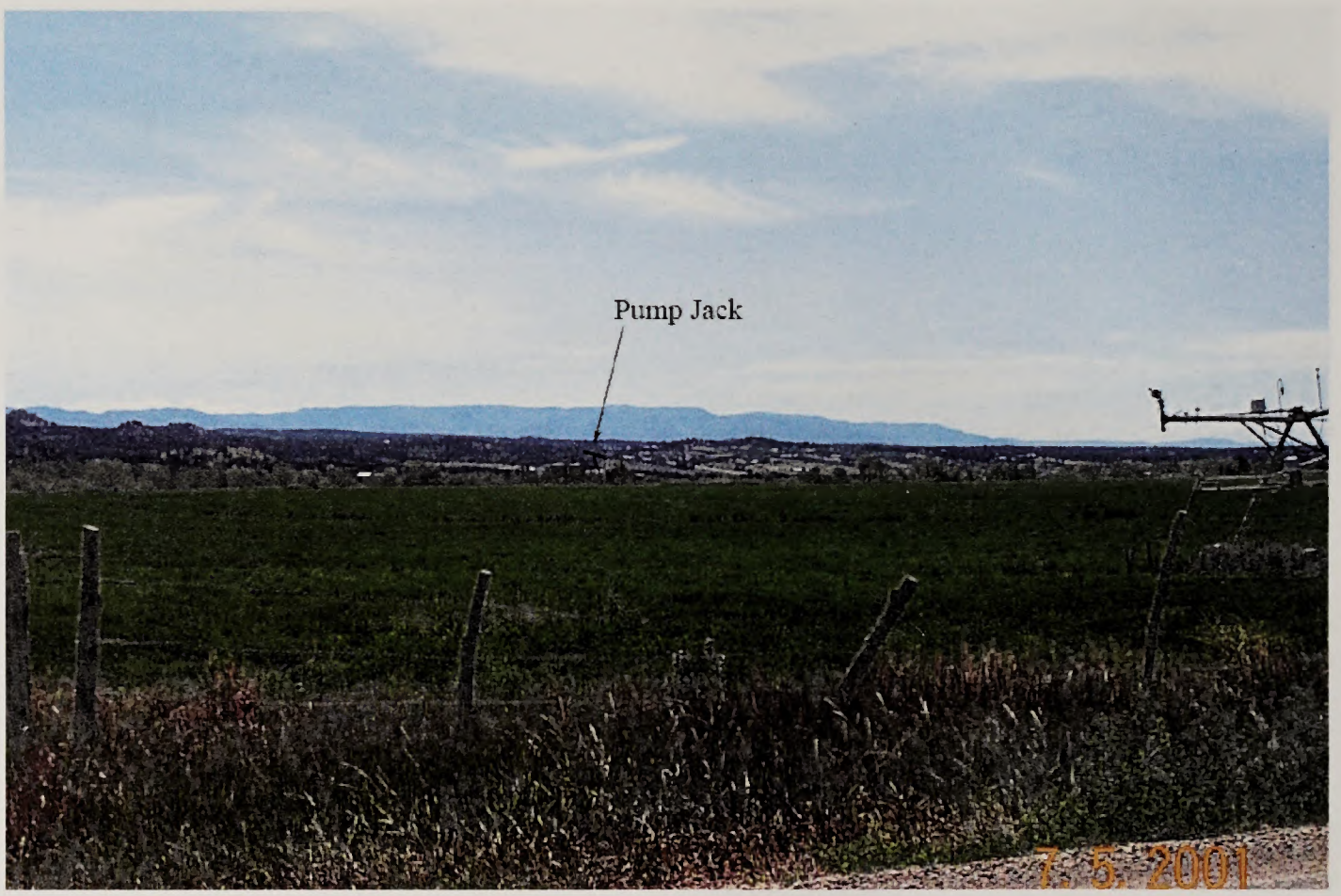


Figure 3–61 **A View Approximately 0.3 mile from a Pump Jack (foreground view) along a Collector Road (south side of La Plata County Road 228)**



Figure 3–62 **A View Approximately 150 feet (foreground view) from a Proposed Well Location in a High-Density Subdivision (Polygon H, Mountain View Subdivision)**

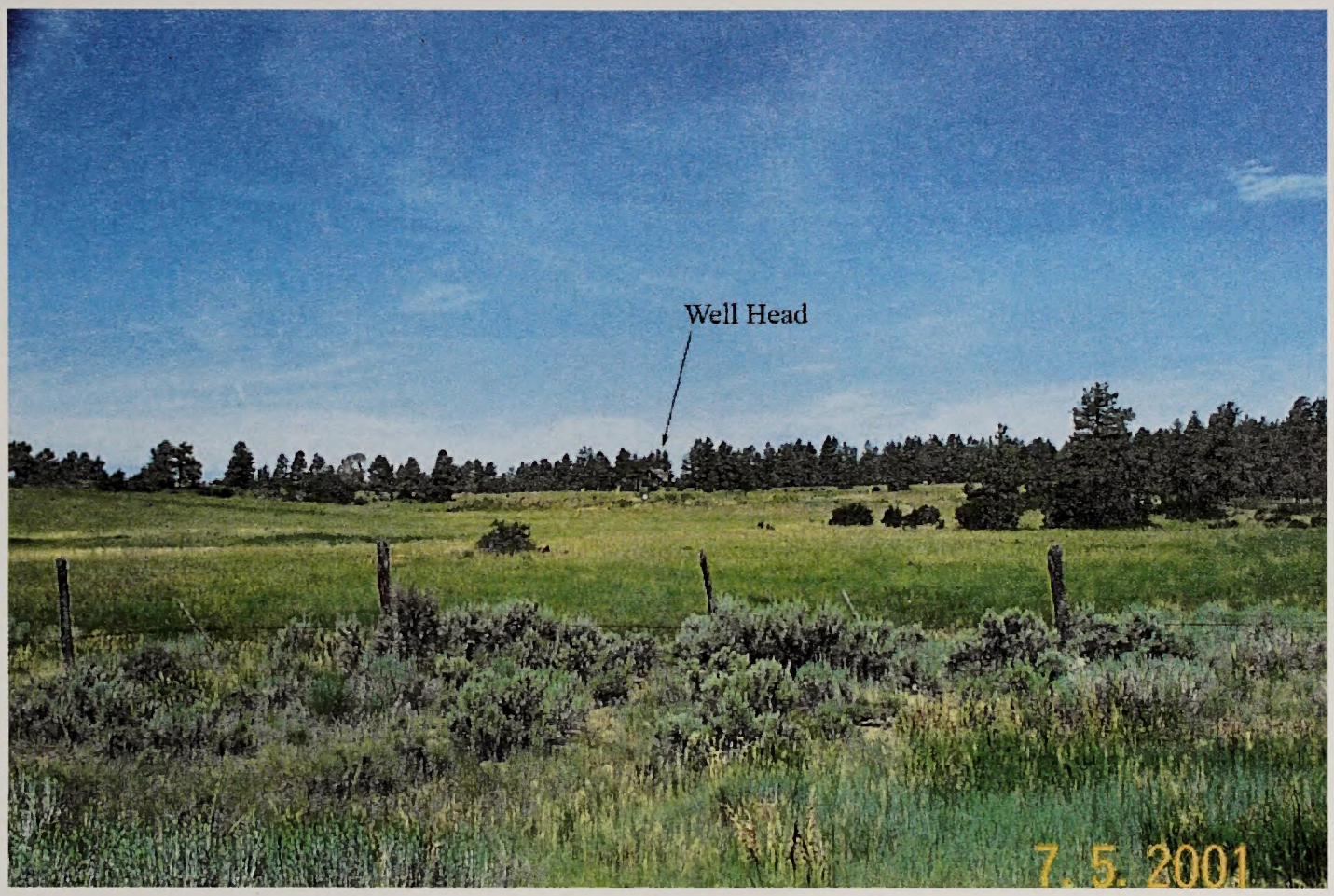


Figure 3–63 A View of a Well Head over 0.50 mile away (middleground view), within a Low-Density Subdivision (northeast portion of Polygon B in the Ticolote Subdivision)



Figure 3–64 A View Approximately 0.66 mile from a Well Head (middleground view) in a Low Use Recreation Area (HD Mountains)

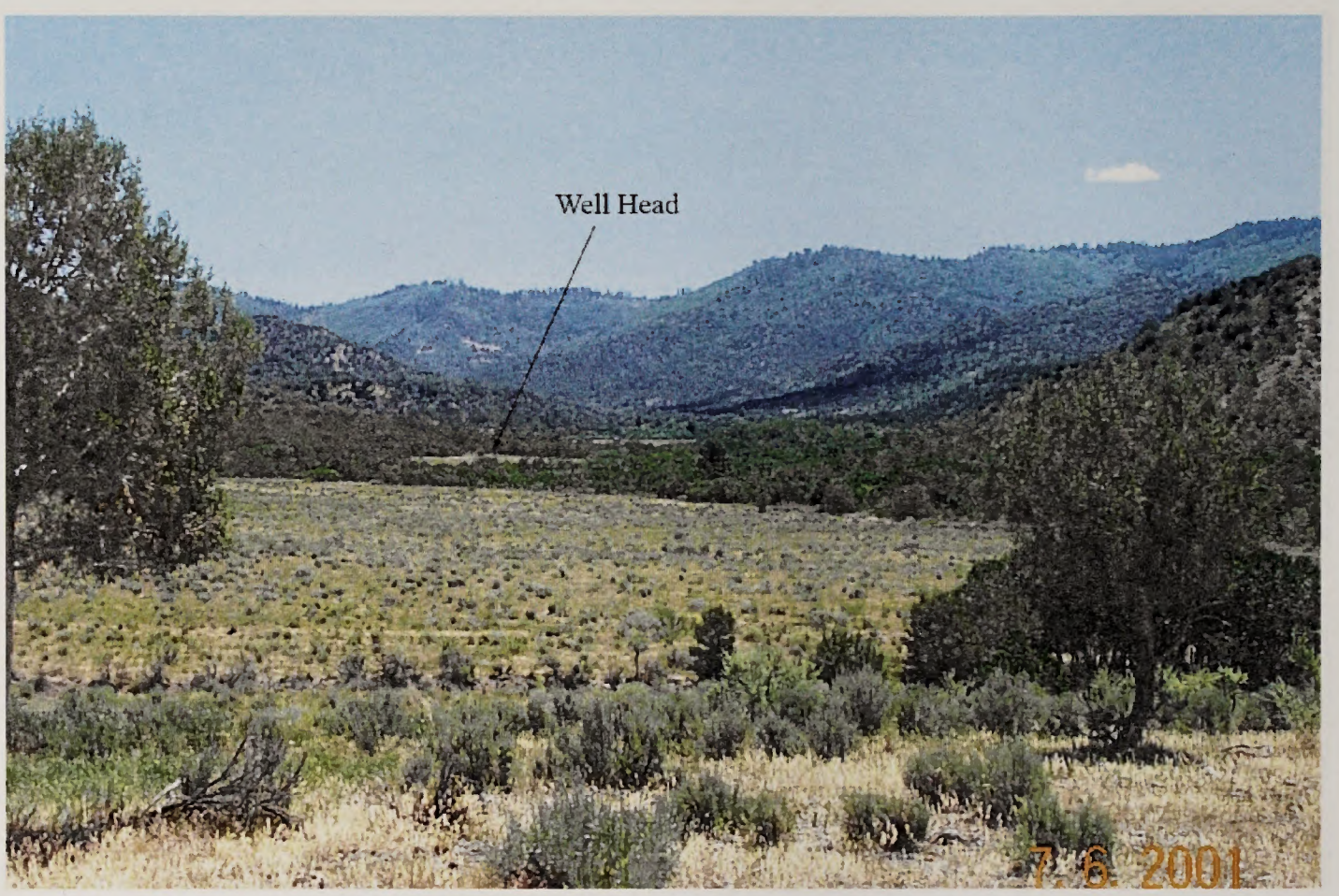


Figure 3–65 **A View Approximately one mile from a Well Head (middleground view) in a Low Use Recreation Area (HD Mountains)**



Figure 3–66 **A View over 0.5 mile from a Pump Jack (middleground view) along a Collector Road (south side of La Plata County Road 228)**



Figure 3–67 A View of a Well Head Approximately 0.75 mile (middleground view) south of a Major Transportation Arterial (Highway 160)

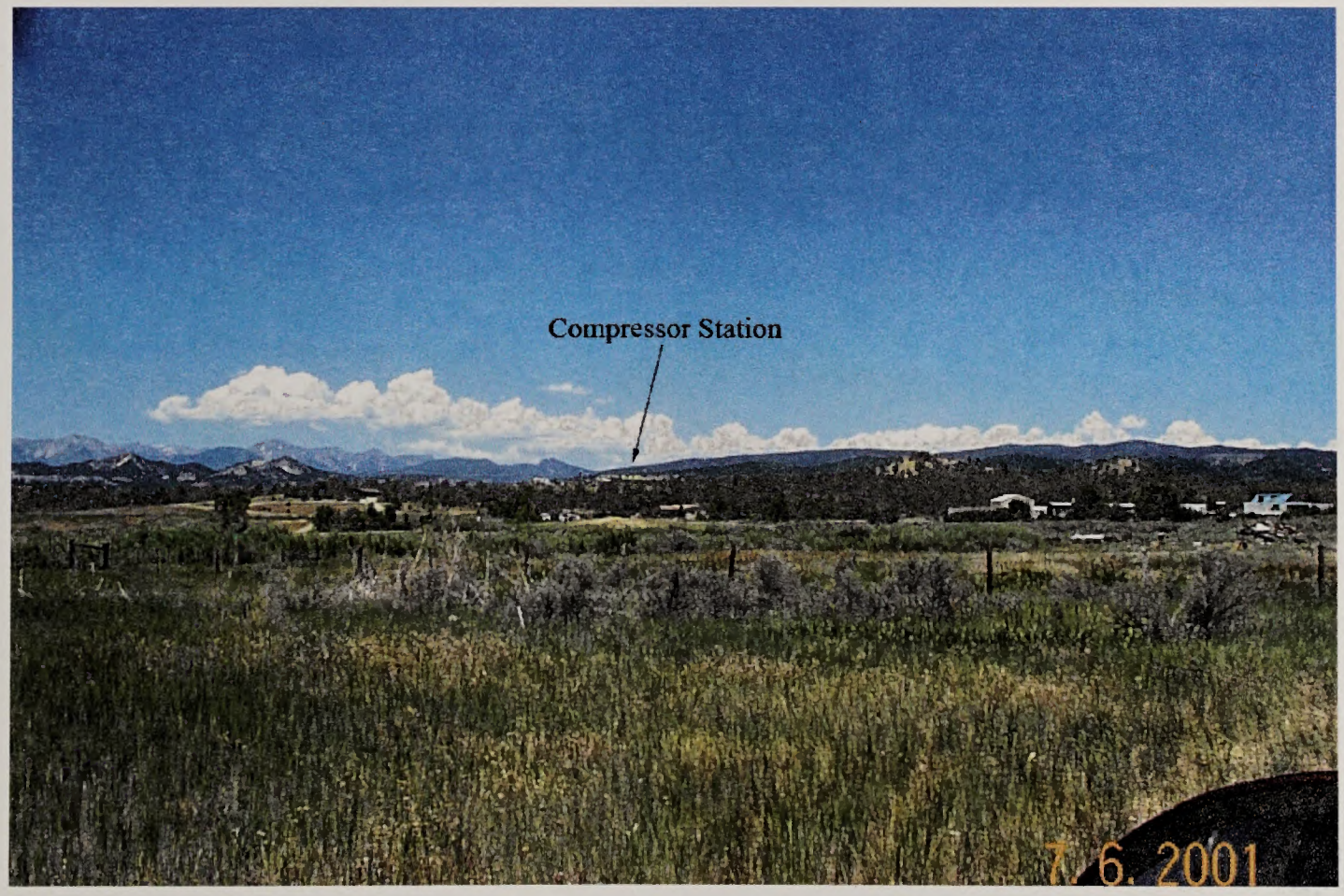


Figure 3–68 A View of a Compressor Station Approximately one mile (middle ground view) north of a Major Transportation Arterial (Highway 160)



Figure 3–69 **A View of a Well Head Approximately 150 feet away (foreground view), within a Low-Density Subdivision (northeast portion of Polygon B in the Ticolote Subdivision)**



Figure 3–70 **A View of a Well Head more than one mile away (middleground view), within a Low-Density Subdivision (NE portion of Polygon B in the Ticolote Subdivision)**

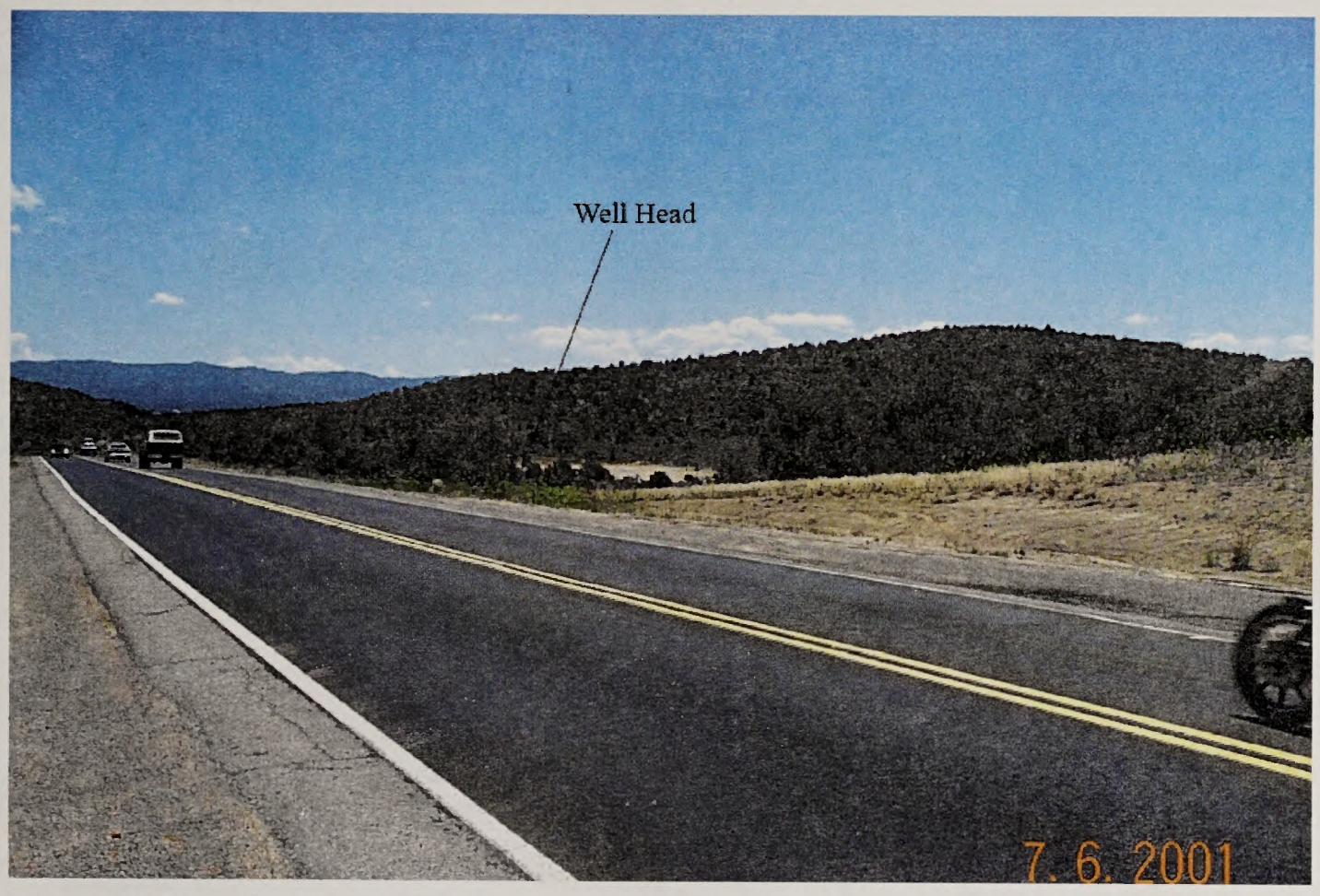
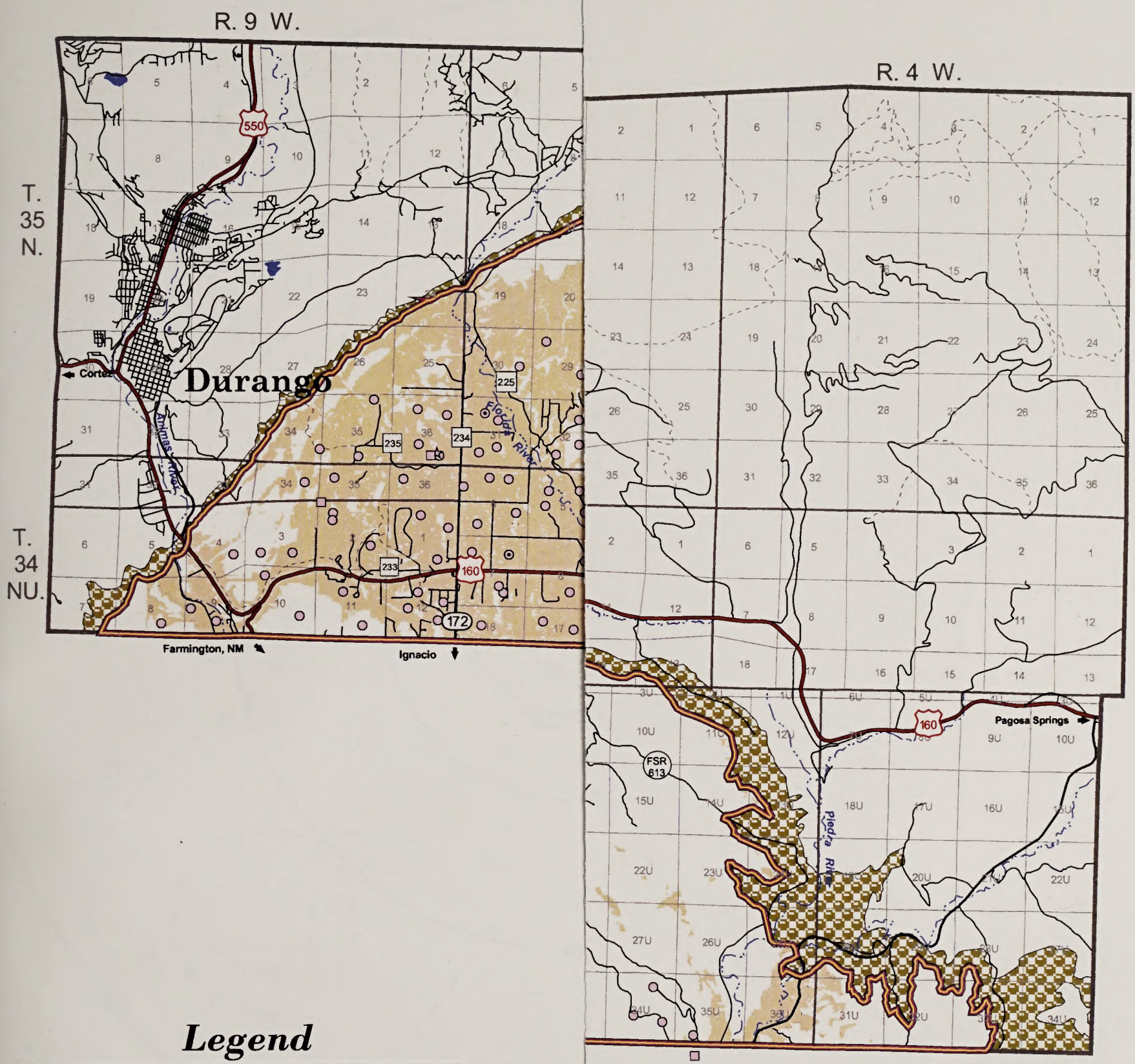


Figure 3–71 **A View Approximately 0.3 mile (foreground view) of a Well Head along a Major Transportation Arterial (Highway 160)**



Legend

- Project Area Boundary
- Existing Compressor
- Existing Non-Fruitland Well
- Existing Fruitland Well
- Existing Disposal Well
- County Line
- U.S. Highway
- Primary Road
- Secondary Road
- Trail
- Lake/Reservoir
- Stream/River
- Fruitland Formation Outcrop
- Seen Areas

Reservation

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database

DEM's.

NORTHERN SAN JUAN BASIN CBM EIS	
FIGURE 3-72 ***AREAS VISIBLE FROM ROADS OR TRANSPORTATION CORRIDORS***	
ANALYSIS AREA: LA PLATA & ARCHULETA COUNTIES, COLORADO	
Date: 04/01/04	ArcView File: C:\994-sanjuan\proj1.apr
	Prepared By: JG

R. 9 W. R. 8 W. R. 7 W. R. 6 W. R. 5 W. R. 4 W.

T. 35 N.

T. 34 NU.

T. 34 N

Durango

Bayfield

Gem Village

Farmington, NM

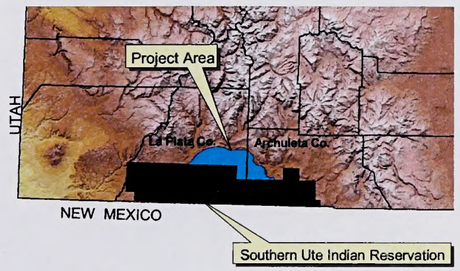
Ignacio

Cortez

Pagosa Springs

Southern Ute Indian Reservation

Southern Ute Indian Reservation



Legend

- Project Area Boundary
- Existing Compressor
- Existing Non-Fruitland Well
- Existing Fruitland Well
- Existing Disposal Well
- County Line
- U.S. Highway
- Primary Road
- Secondary Road
- Trail
- Lake/Reservoir
- Stream/River
- Fruitland Formation Outcrop
- Seen Areas

N W E S

2 0 2 4 6 8 *Kilometers*

2 0 2 4 6 8 *Miles*

La Plata County transportation data provided by the La Plata County Transportation Study, 1998. Hydrologic and Archuleta County transportation features extracted from 1:100,000 USGS SDTS data. Existing wells extracted from COGCC well database and edited by the BLM & USFS. Viewshed developed from 10 meter USGS DEM's.

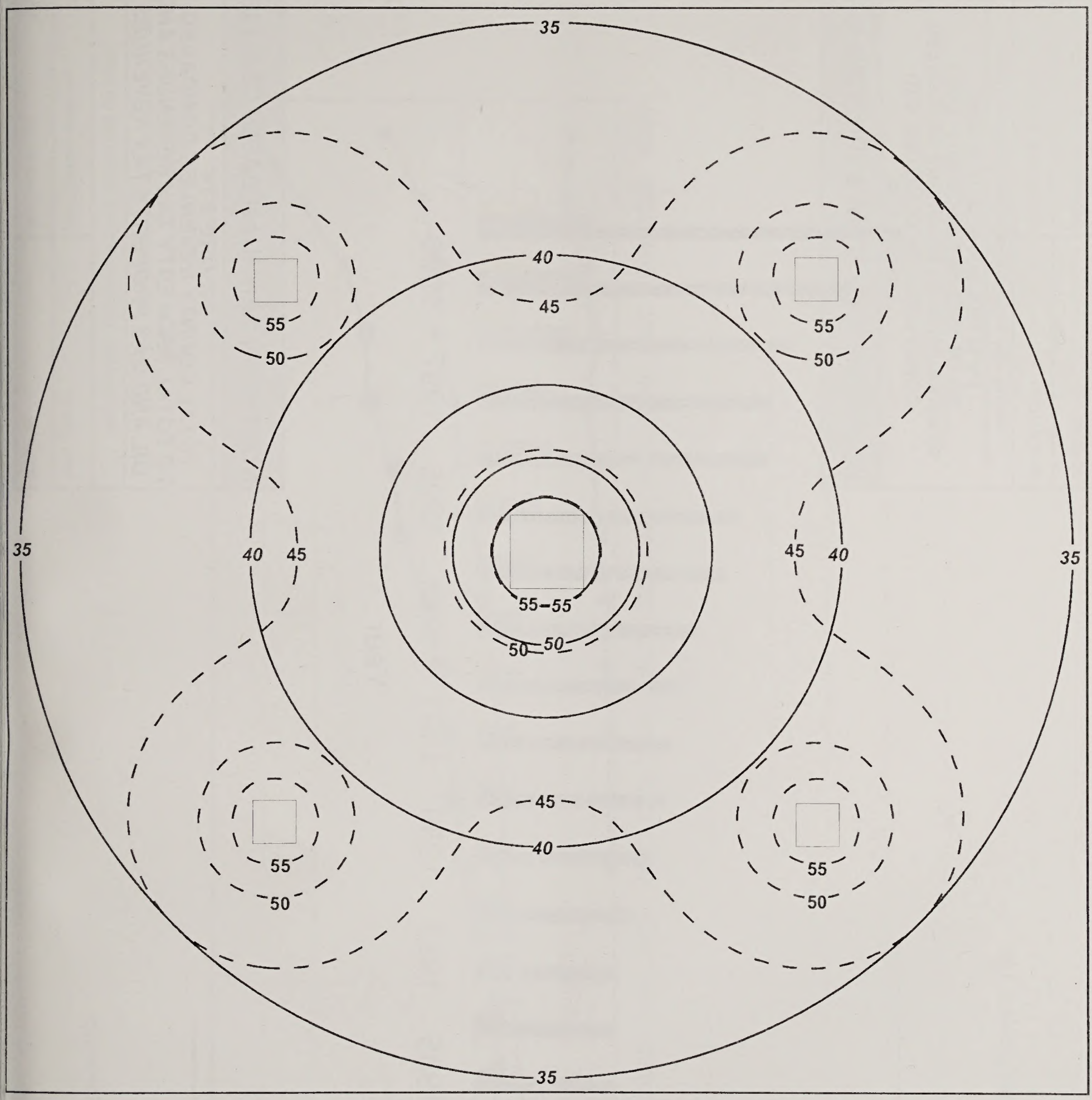
Transverse Mercator Projection
1927 North American Datum
Zone 13

NORTHERN SAN JUAN BASIN CBM EIS

FIGURE 3-72
AREAS VISIBLE FROM ROADS OR TRANSPORTATION CORRIDORS

ANALYSIS AREA: LA PLATA & ARCHULETA COUNTIES, COLORADO

Date: 04/01/04	ArcView File: C:\994-sanjuan\proj1.apr
	Prepared By: JG



1 Mile

LEGEND

—50— Noise (dBA) from Compressor Only

- -50- - Cumulative Noise (dBA) from Compressor and Pump Jacks

Proposed CBM Well Pad (210ft x 210ft)

Proposed Compressor Pad (360ft x 360ft)

0 700 1400

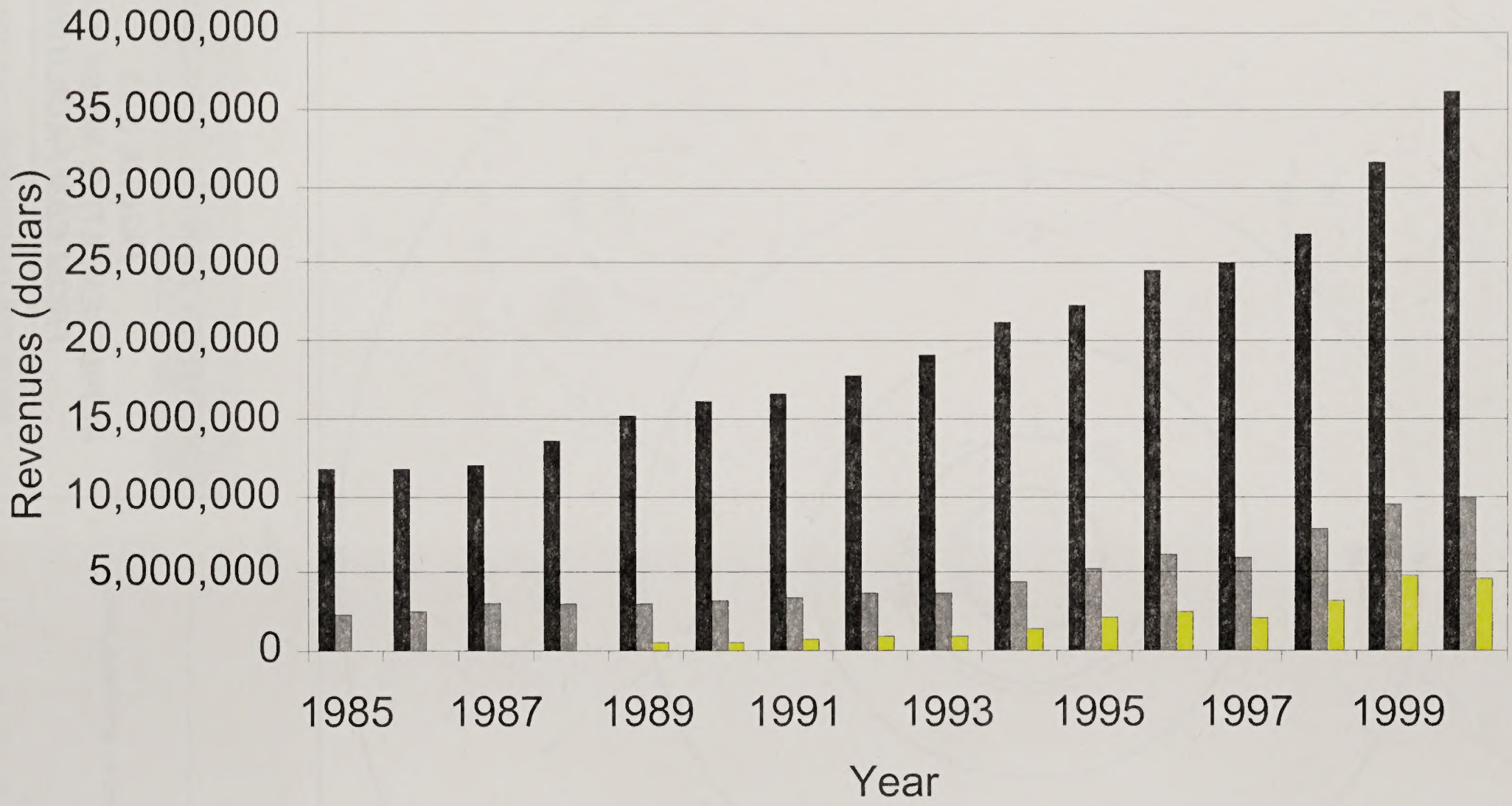
Scale (ft)

NORTHERN SAN JUAN BASIN CBM EIS

FIGURE 3-73
REPRESENTATIVE NOISE IMPACTS FROM CBM FACILITIES

ANALYSIS AREA: LA PLATA & ARCHULETA COUNTIES, COLORADO

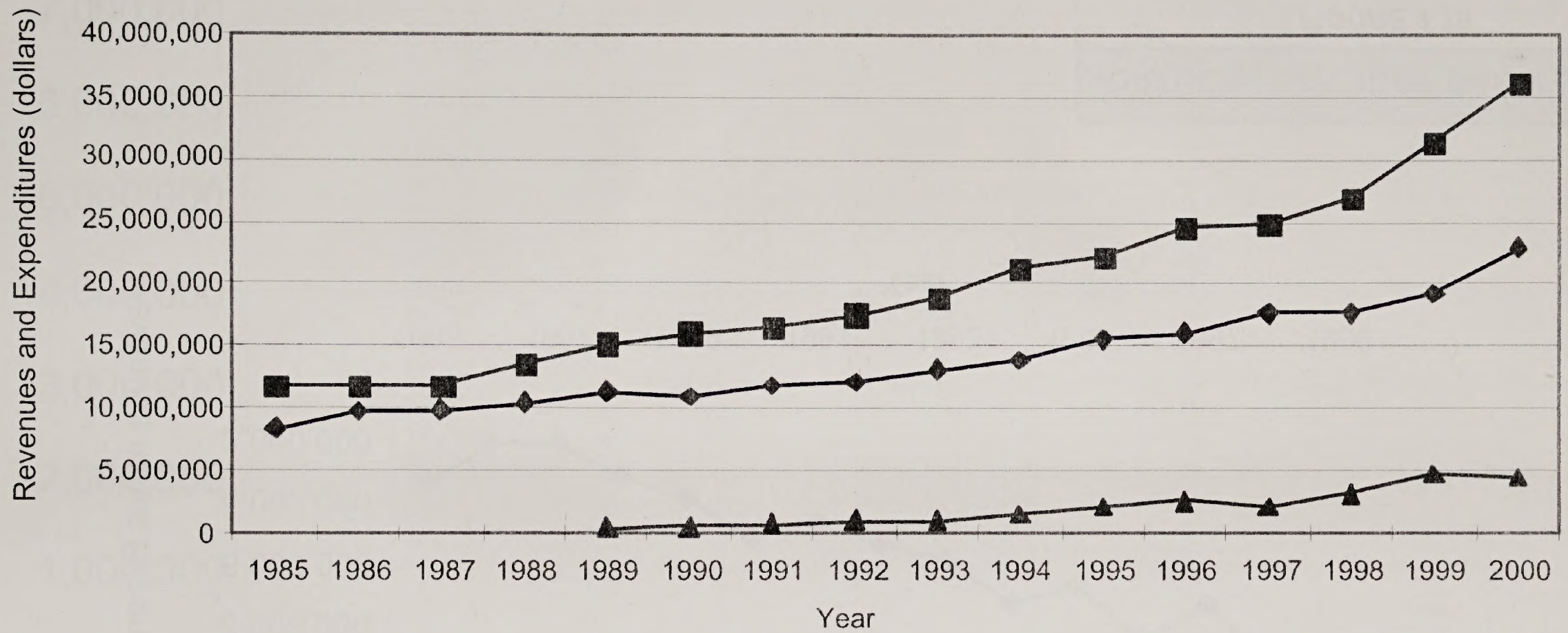
DATE: 04.01.04	AUTOCAD FILE:994 IMPACTS.DWG
SCALE: NTS	PREPARED BY: ETC



LEGEND

- Total Revenues
- Property Tax Revenues
- Oil and Gas Property Tax Revenues

NORTHERN SAN JUAN BASIN CBM EIS	
FIGURE 3-74 TOTAL COUNTY REVENUES COMPARED TO TOTAL PROPERTY TAX REVENUES AND OIL AND GAS PROPERTY TAX REVENUES	
ANALYSIS AREA: LA PLATA & ARCHULETA COUNTIES, COLORADO	
DATE: 04.01.04	AUTOCAD FILE: 994figs.dwg
SCALE: nts	PREPARED BY: ETC



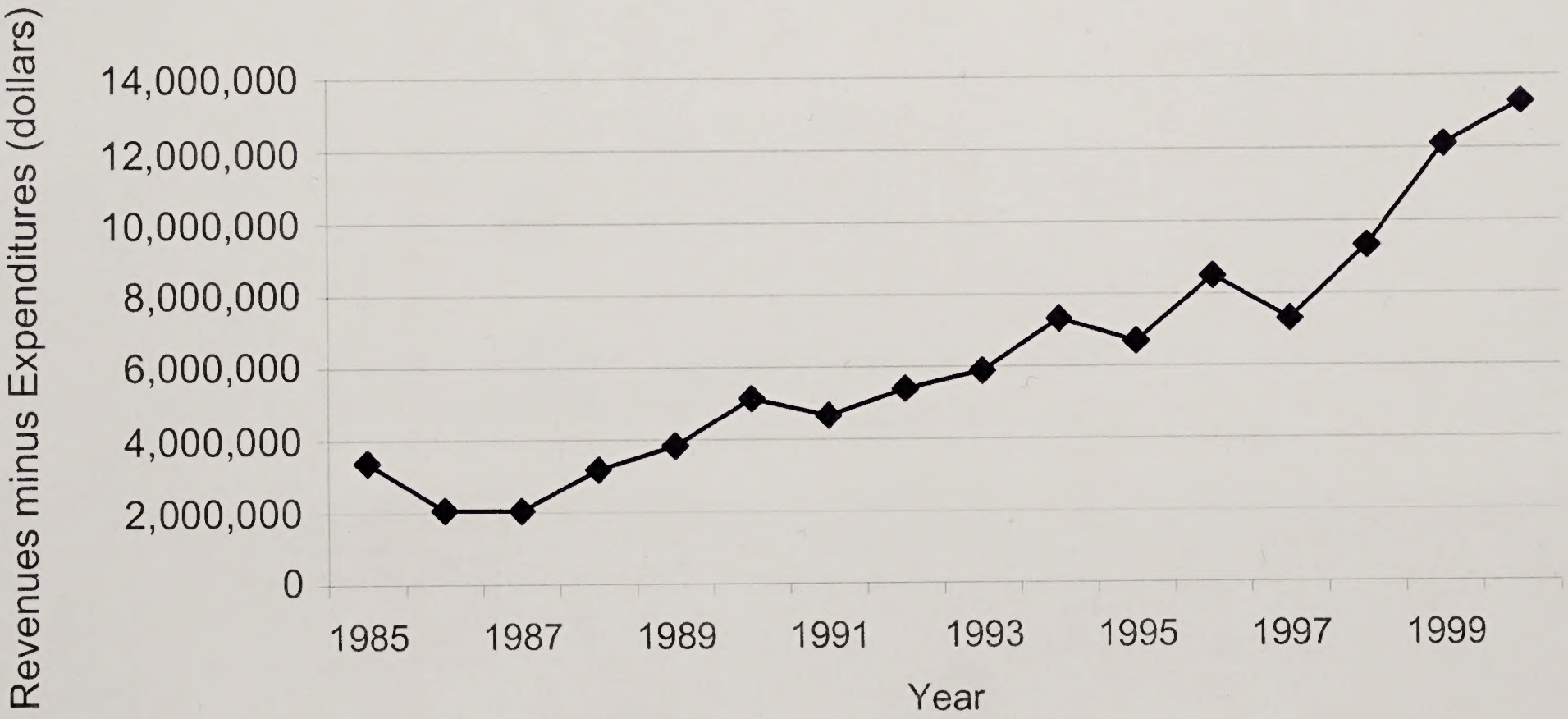
LEGEND

- Revenues
- Expenditures
- Revenues from Oil and Gas Property Tax

NORTHERN SAN JUAN BASIN CBM EIS

FIGURE 3-75
COMPARISON OF REVENUES AND EXPENDITURES TO REVENUES GENERATED BY OIL AND GAS PROPERTY TAX, LA PLATA COUNTY, 1985-2000

ANALYSIS AREA: LA PLATA & ARCHULETA COUNTIES, COLORADO	
DATE: 04.01.04	AUTOCAD FILE: 994figs.dwg
SCALE: nts	PREPARED BY: ETC

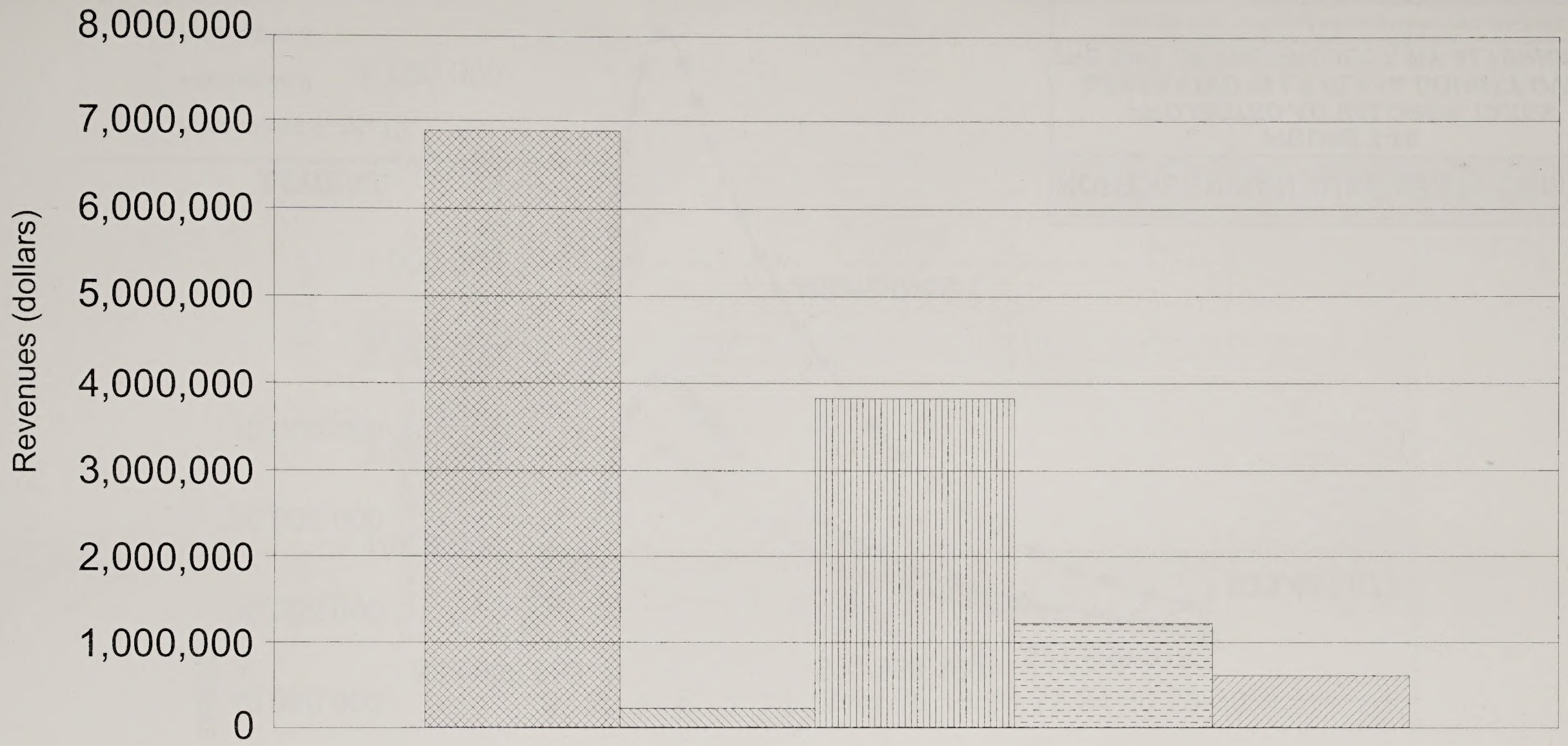


NORTHERN SAN JUAN BASIN CBM EIS

FIGURE 3-76
LA PLATA COUNTY NET REVENUES, 1985-2000

ANALYSIS AREA: LA PLATA & ARCHULETA COUNTIES, COLORADO

DATE: 04.01.04	AUTOCAD FILE: 994figs.dwg
SCALE: nts	PREPARED BY: ETC



LEGEND

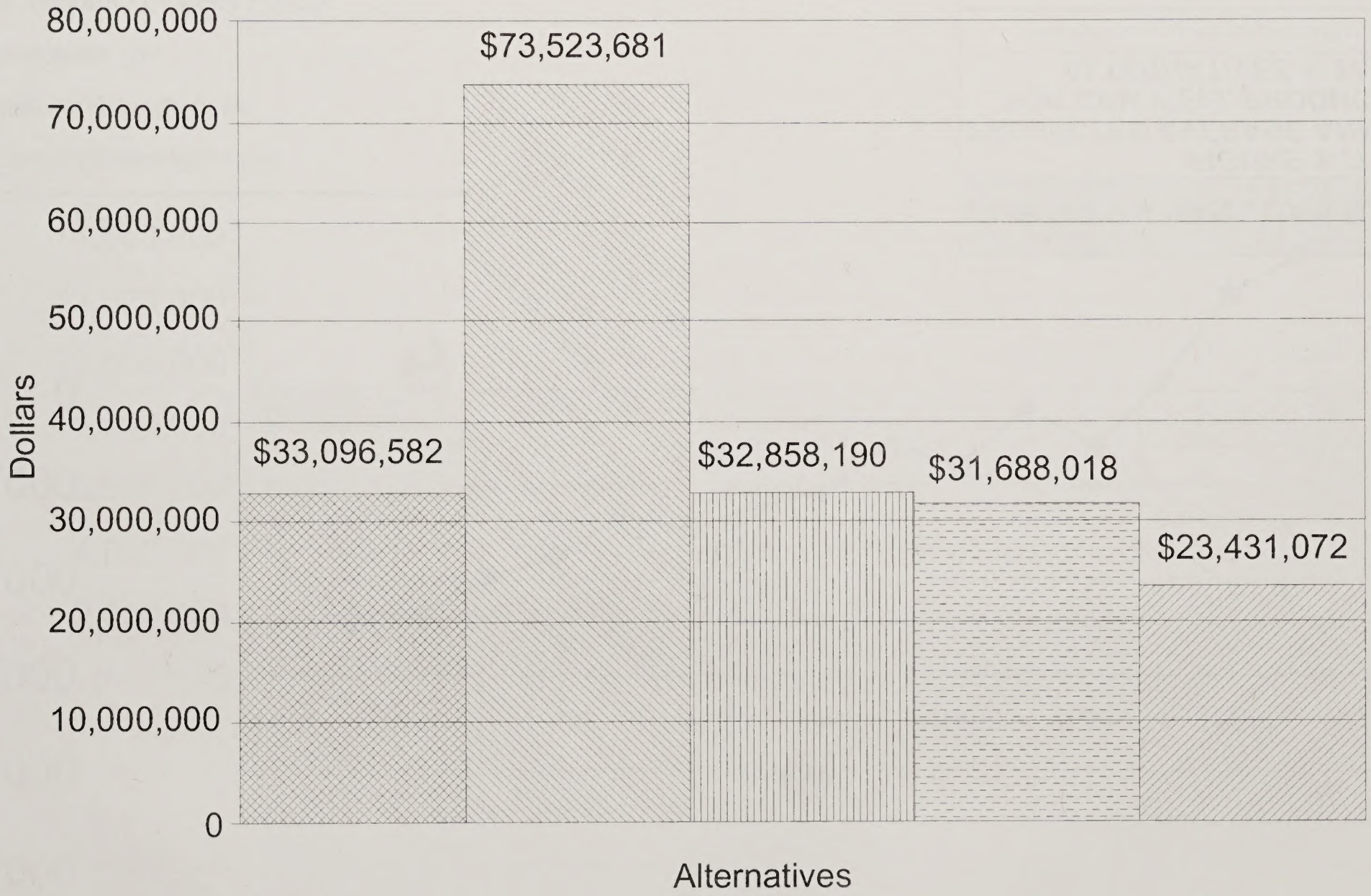
- Federal Mineral Royalties
- State Mineral Royalties
- Severance Tax
- Ad Valorem - La Plata County
- Ad Valorem - Archuleta County

NORTHERN SAN JUAN BASIN CBM EIS

FIGURE 3-77
PROJECTED AVERAGE ANNUAL REVENUE FOR CBM WELL PRODUCTION UNDER ALTERNATIVES 1, 1A, AND 1B

ANALYSIS AREA: LA PLATA & ARCHULETA COUNTIES, COLORADO

DATE: 04.01.04	AUTOCAD FILE: 994figs.dwg
SCALE: nts	PREPARED BY: ETC



LEGEND

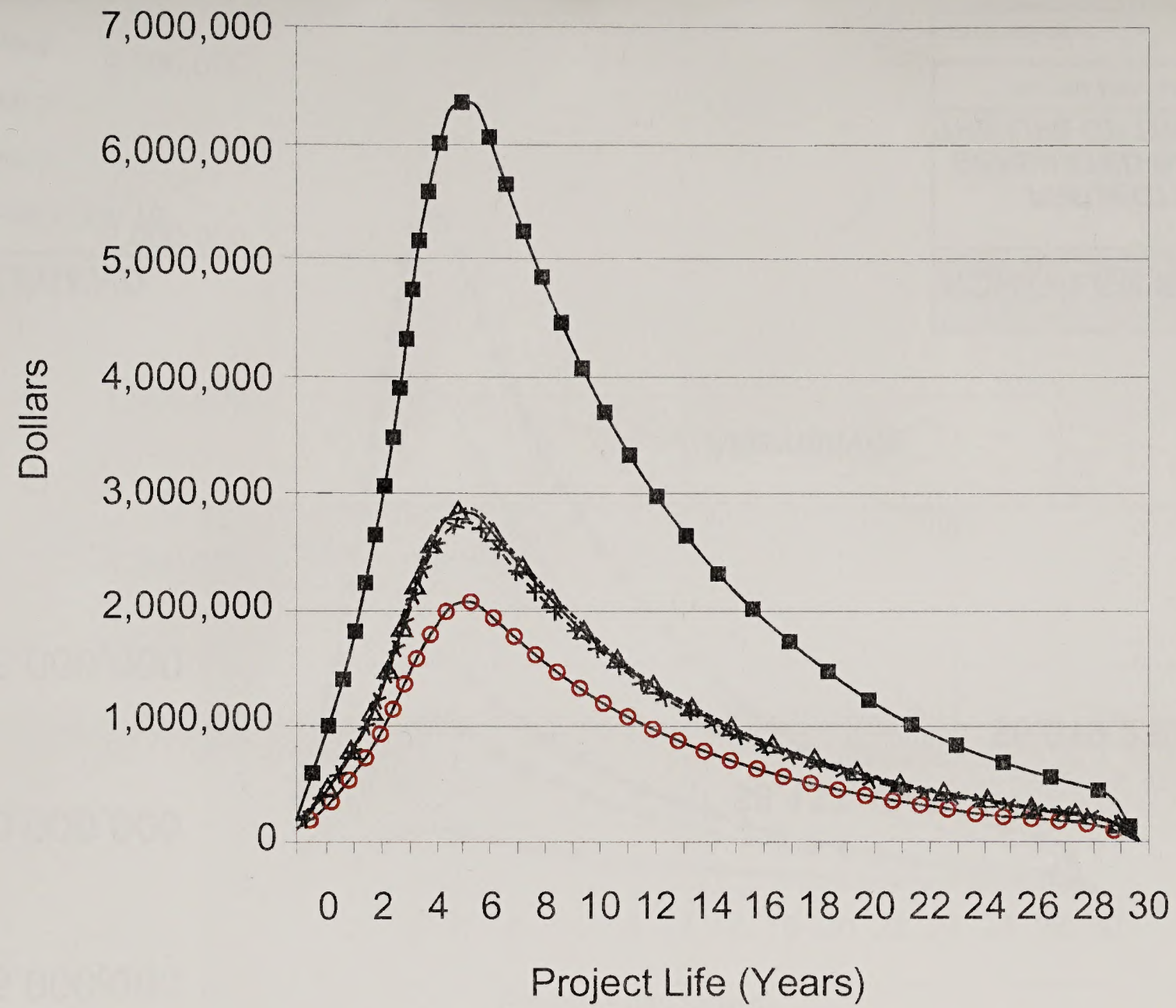
- Alternatives 1, 1A, 1B
- Alternative 2
- Alternative 3
- Alternative 4
- Alternative 5

NORTHERN SAN JUAN BASIN CBM EIS

FIGURE 3-78
PROJECTED AD VALOREM TAXES GENERATED IN LA PLATA COUNTY OVER THE LIFE OF THE PROJECT, BY ALTERNATIVE

ANALYSIS AREA: LA PLATA & ARCHULETA COUNTIES, COLORADO

DATE: 04.01.04	AUTOCAD FILE: 994figs.dwg
SCALE: nts	PREPARED BY: ETC



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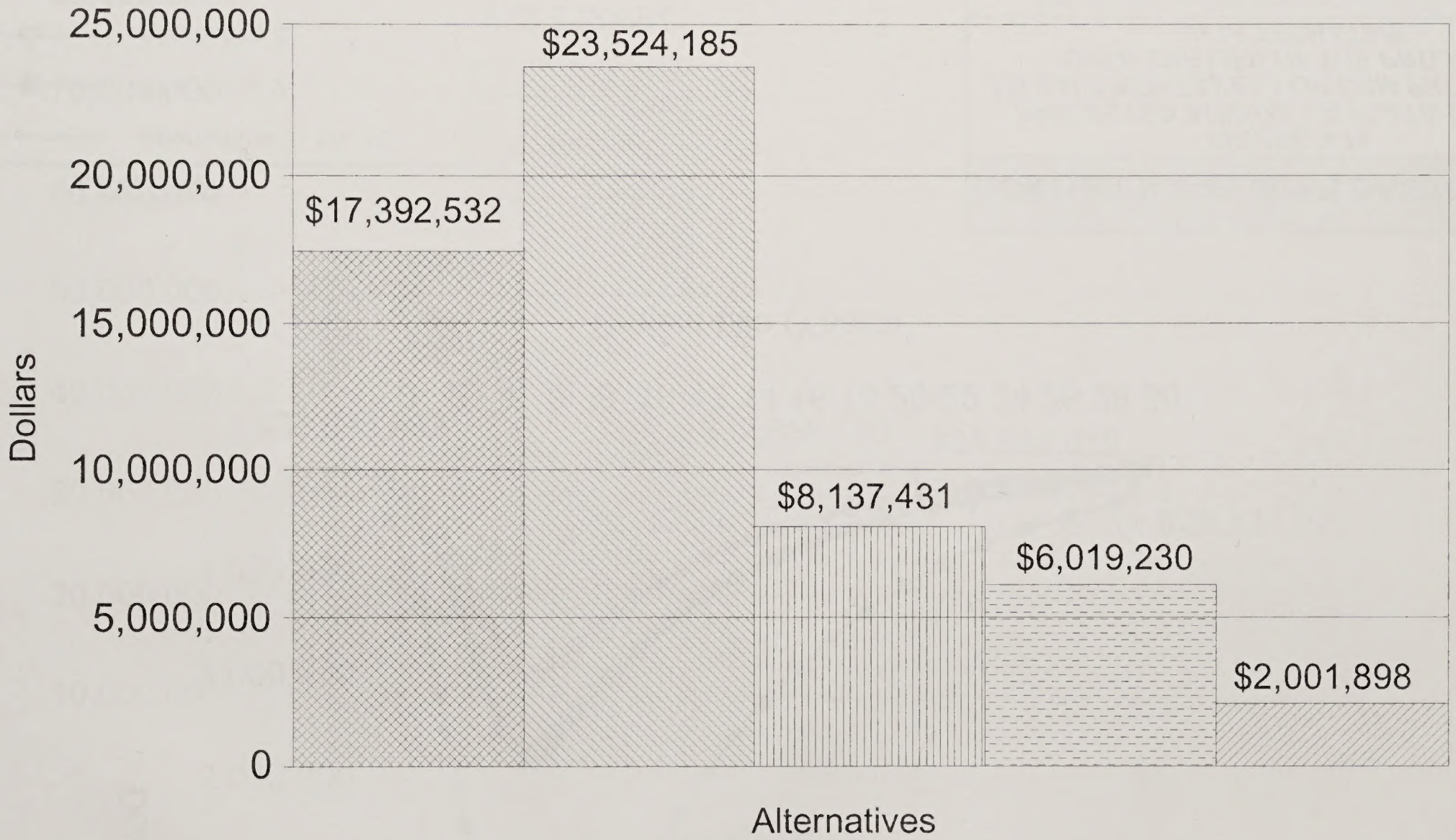
- Alternatives 1, 1A, 1B
- Alternative 2
- Alternative 3
- Alternative 4
- Alternative 5

NORTHERN SAN JUAN BASIN CBM EIS

FIGURE 3-79
PROJECTED ANNUAL LA PLATA COUNTY AD VALOREM TAXES FOR CBM PRODUCTION OVER THE LIFE OF THE PROJECT, BY ALTERNATIVE

ANALYSIS AREA: LA PLATA & ARCHULETA COUNTIES, COLORADO

DATE: 04.01.04	AUTOCAD FILE: 994figs.dwg
SCALE: nts	PREPARED BY: ETC



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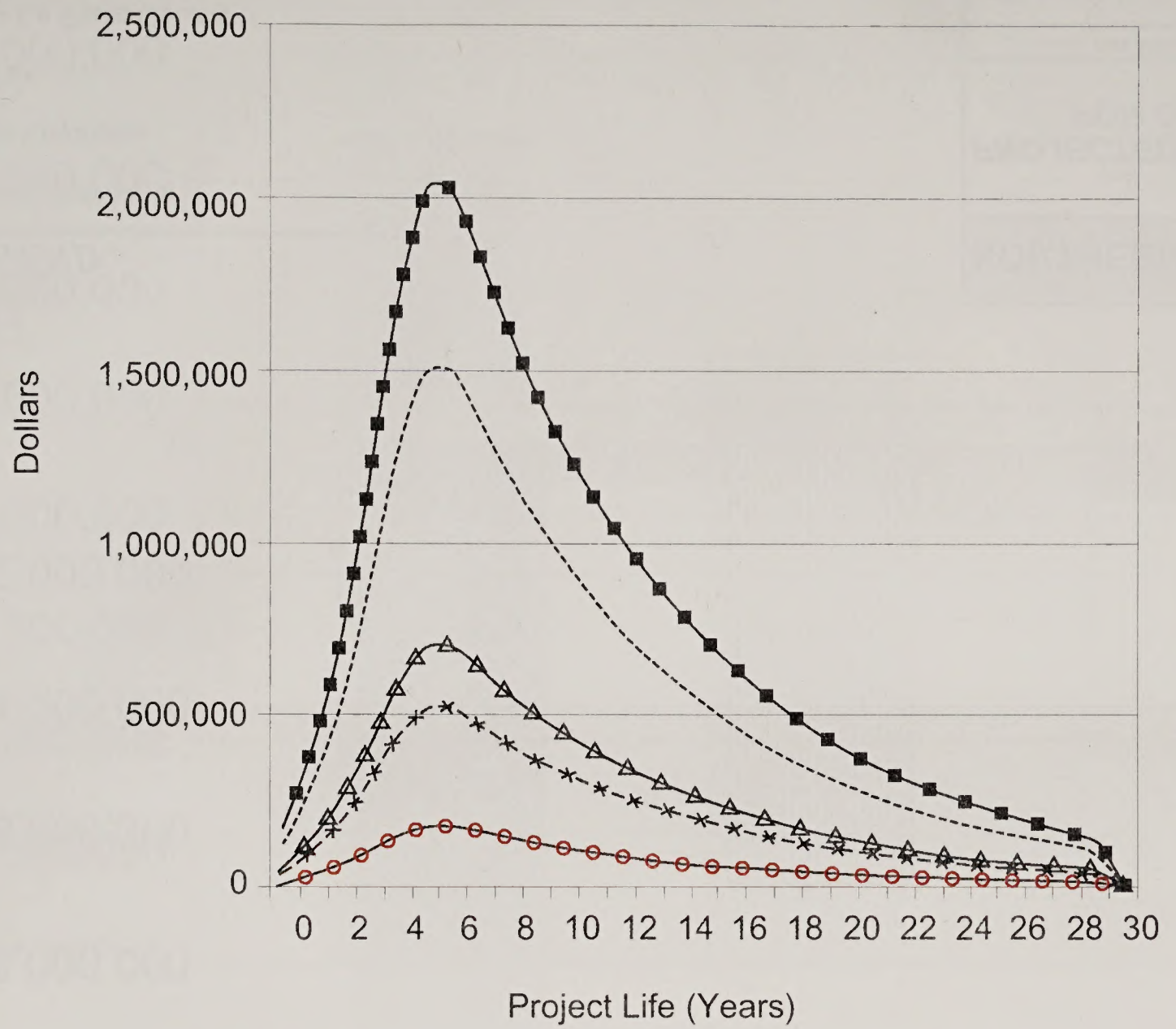
- Alternatives 1, 1A, 1B
- Alternative 2
- Alternative 3
- Alternative 4
- Alternative 5

NORTHERN SAN JUAN BASIN CBM EIS

FIGURE 3-80
PROJECTED AD VALOREM TAXES GENERATED IN ARCHULETA COUNTY OVER THE LIFE OF THE PROJECT, BY ALTERNATIVE

ANALYSIS AREA: LA PLATA & ARCHULETA COUNTIES, COLORADO

DATE: 04.01.04	AUTOCAD FILE: 994figs.dwg
SCALE: nts	PREPARED BY: ETC



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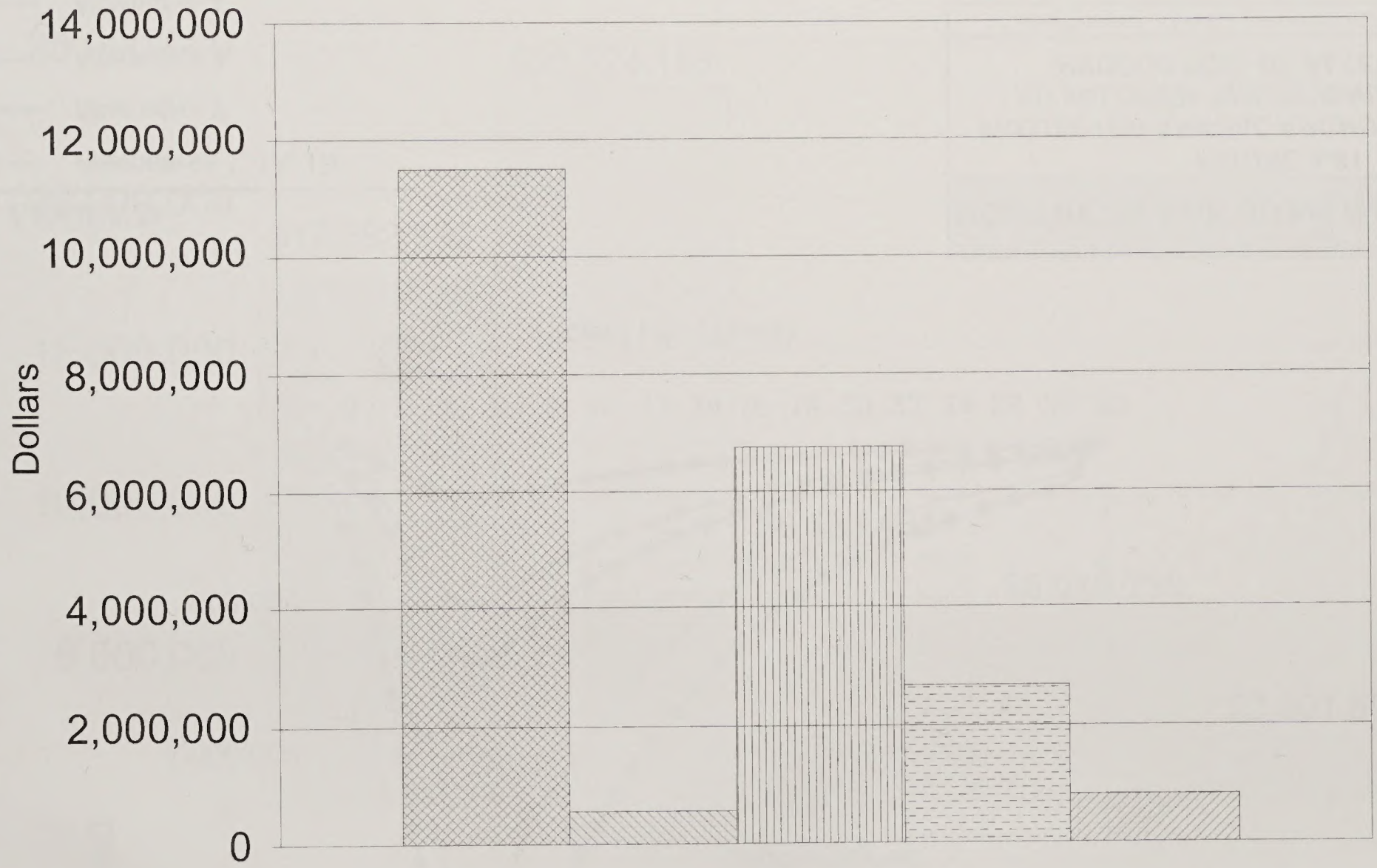
- Alternatives 1, 1A, 1B
- Alternative 2
- Alternative 3
- Alternative 4
- Alternative 5

NORTHERN SAN JUAN BASIN CBM EIS

FIGURE 3-81
PROJECTED ANNUAL ARCHULETA COUNTY AD VALOREM TAX REVENUE FOR CBM PRODUCTION, BY ALTERNATIVE

ANALYSIS AREA: LA PLATA & ARCHULETA COUNTIES, COLORADO

DATE: 04.01.04	AUTOCAD FILE: 994figs.dwg
SCALE: nts	PREPARED BY: ETC



LEGEND

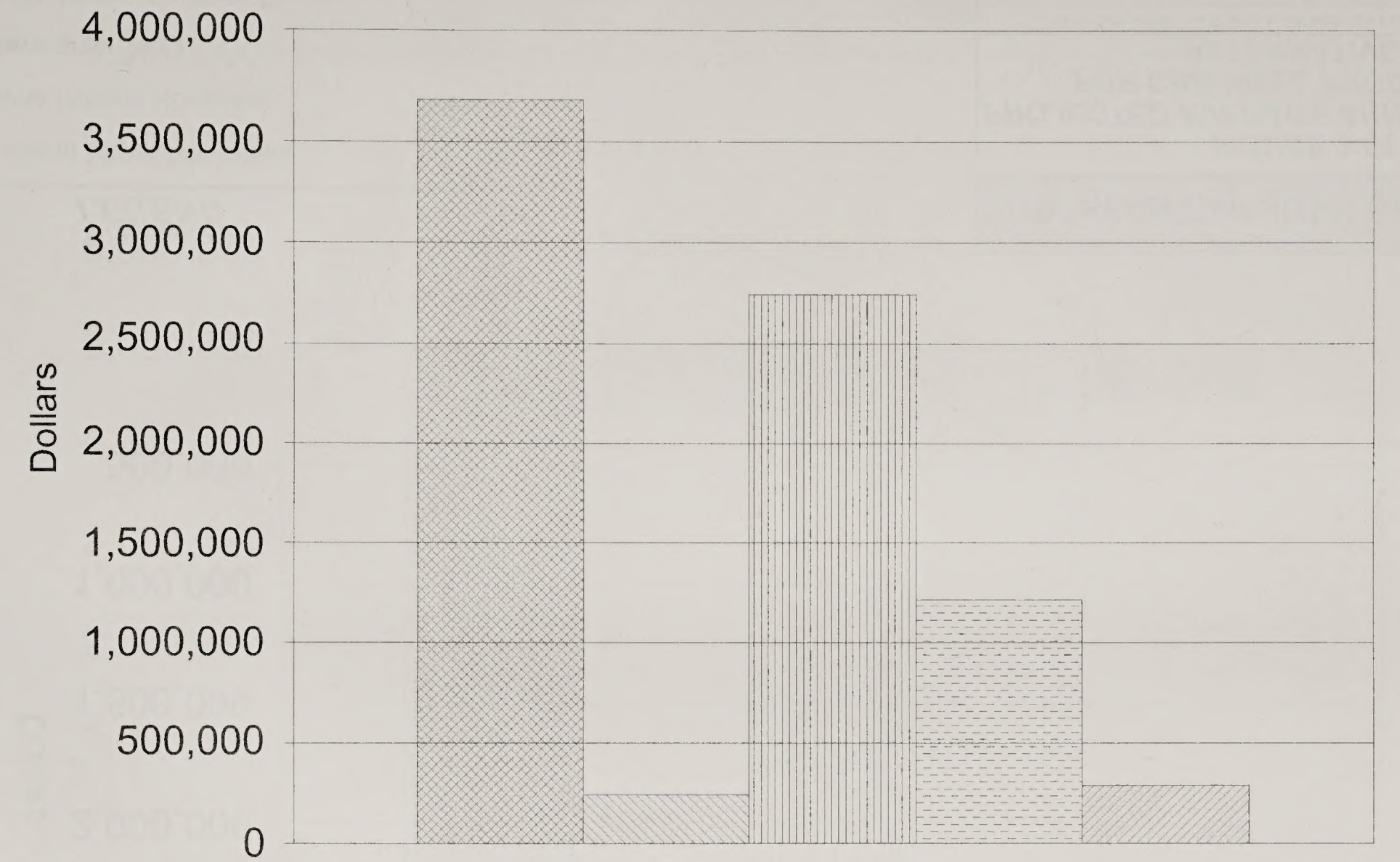
- Federal Mineral Royalties
- State Mineral Royalties
- Severance Tax
- Ad Valorem - La Plata County
- Ad Valorem - Archuleta County

NORTHERN SAN JUAN BASIN CBM EIS

FIGURE 3-82
PROJECTED AVERAGE ANNUAL REVENUE FOR CBM WELL PRODUCTION, ALTERNATIVE 2

ANALYSIS AREA: LA PLATA & ARCHULETA COUNTIES, COLORADO

DATE: 04.01.04	AUTOCAD FILE: 994figs.dwg
SCALE: nts	PREPARED BY: ETC



LEGEND

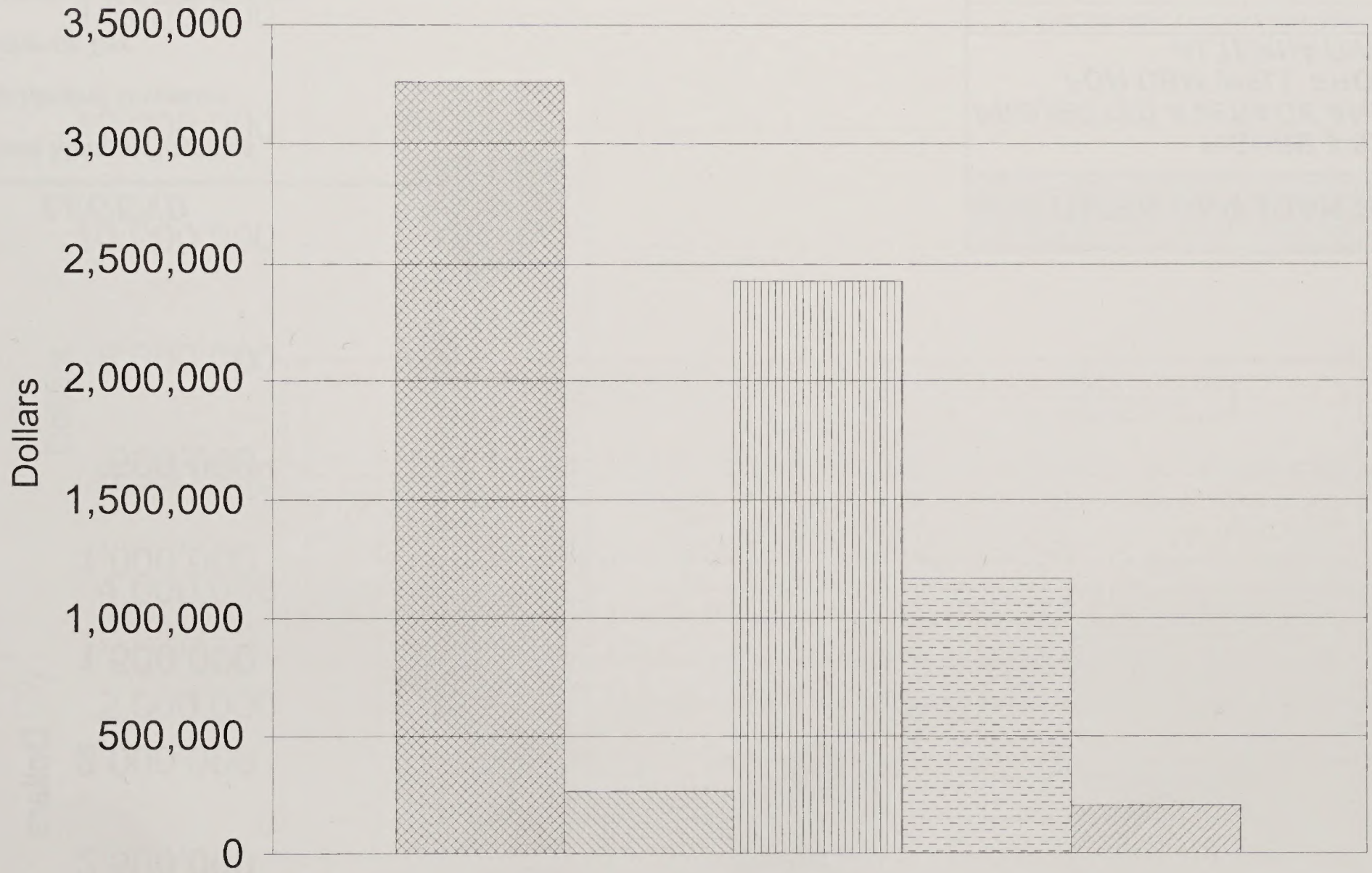
- Federal Mineral Royalties
- State Mineral Royalties
- Severance Tax
- Ad Valorem - La Plata County
- Ad Valorem - Archuleta County

NORTHERN SAN JUAN BASIN CBM EIS

FIGURE 3-83
PROJECTED AVERAGE ANNUAL REVENUE FOR CBM WELL PRODUCTION, ALTERNATIVE 3

ANALYSIS AREA: LA PLATA & ARCHULETA COUNTIES, COLORADO

DATE: 04.01.04	AUTOCAD FILE: 994figs.dwg
SCALE: nts	PREPARED BY: ETC



LEGEND

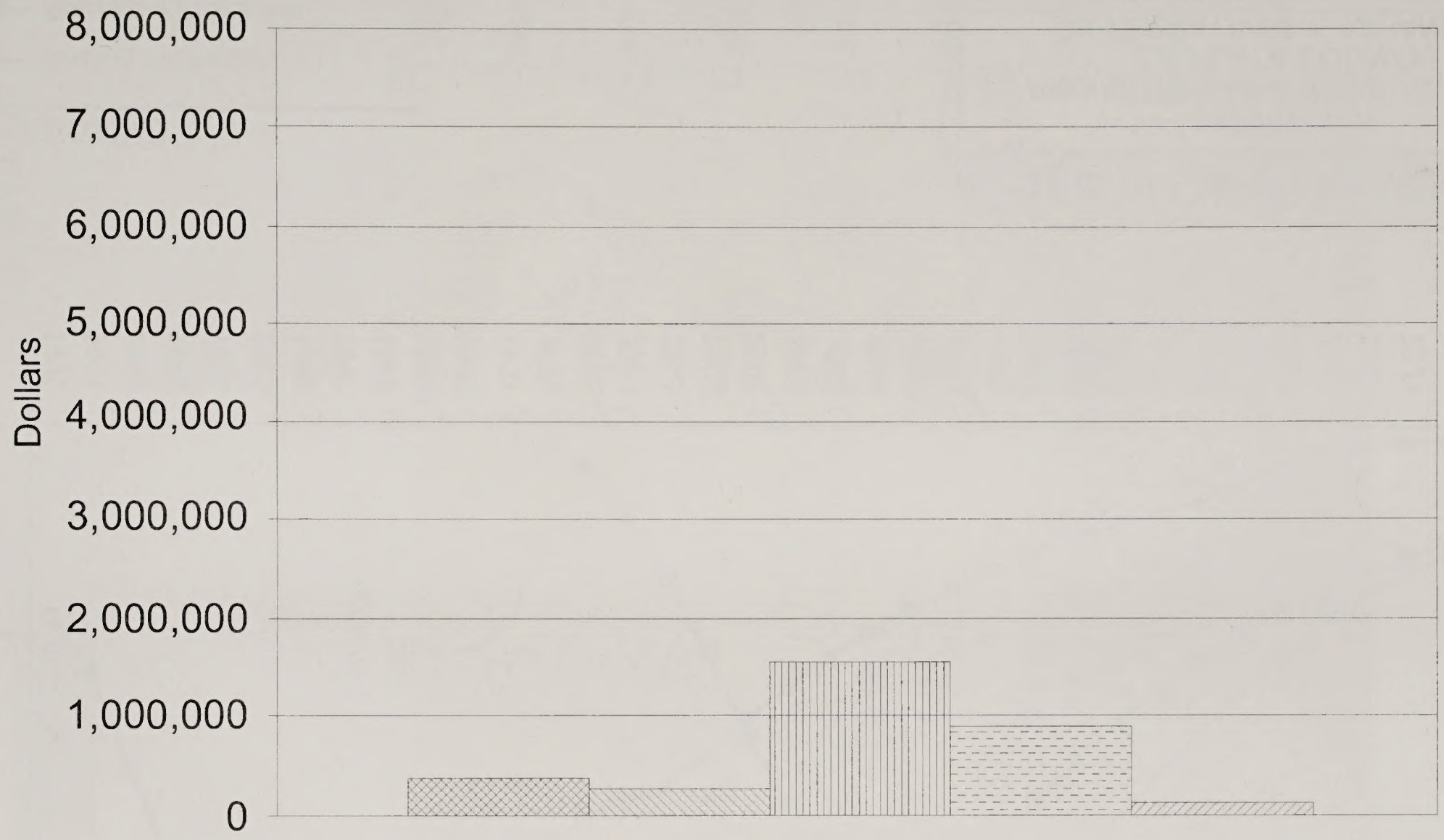
- Federal Mineral Royalties
- State Mineral Royalties
- Severance Tax
- Ad Valorem - La Plata County
- Ad Valorem - Archuleta County

NORTHERN SAN JUAN BASIN CBM EIS

FIGURE 3-84
PROJECTED AVERAGE ANNUAL REVENUE FOR CBM WELL PRODUCTION, ALTERNATIVE 4

ANALYSIS AREA: LA PLATA & ARCHULETA COUNTIES, COLORADO

DATE: 04.01.04	AUTOCAD FILE: 994figs.dwg
SCALE: nts	PREPARED BY: ETC



LEGEND

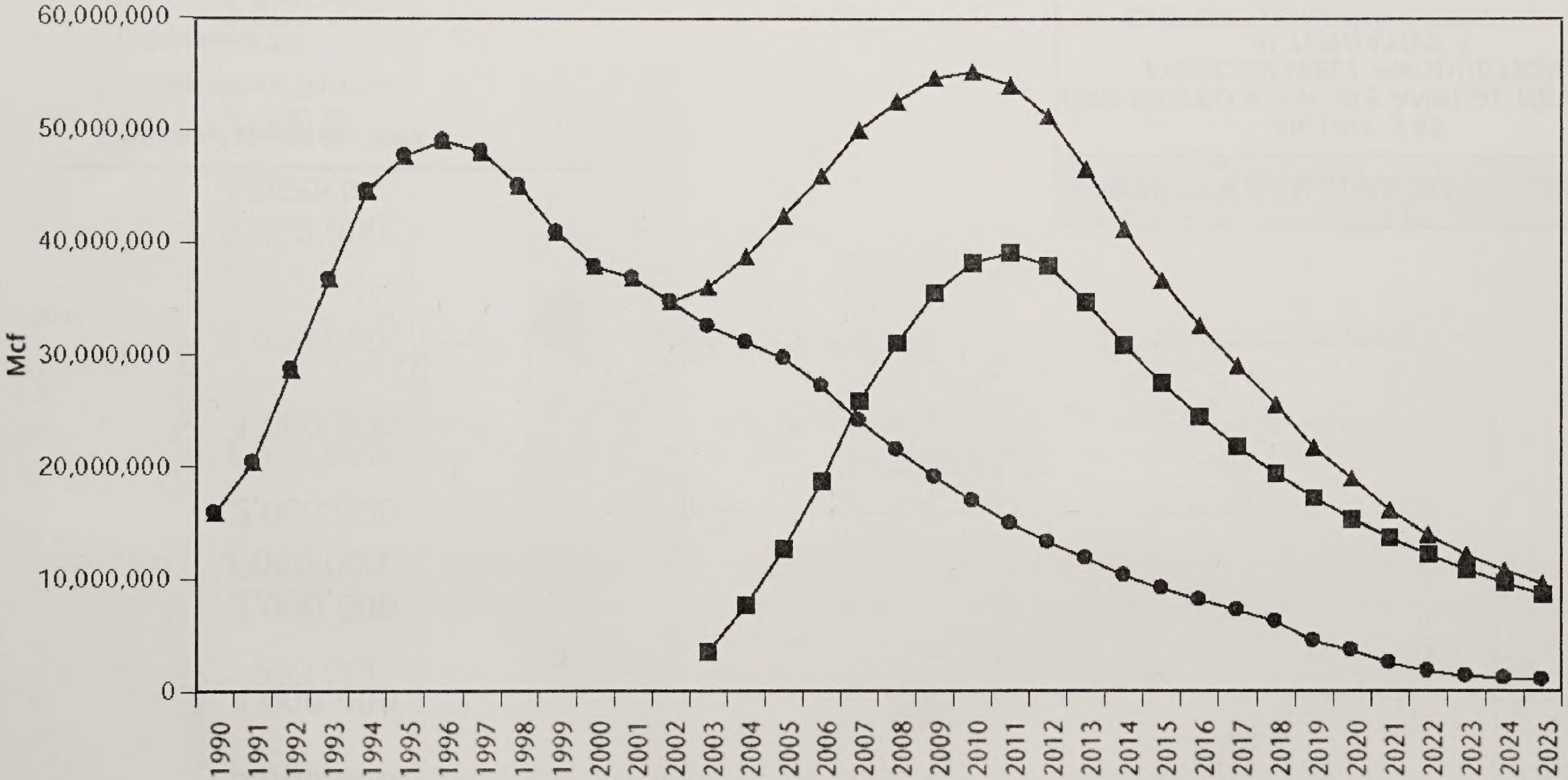
- Federal Mineral Royalties
- State Mineral Royalties
- Severance Tax
- Ad Valorem - La Plata County
- Ad Valorem - Archuleta County

NORTHERN SAN JUAN BASIN CBM EIS

FIGURE 3-85
PROJECTED AVERAGE ANNUAL REVENUE FOR CBM WELL PRODUCTION, ALTERNATIVE 5

ANALYSIS AREA: LA PLATA & ARCHULETA COUNTIES, COLORADO

DATE: 04.01.04	AUTOCAD FILE: 994figs.dwg
SCALE: nts	PREPARED BY: ETC



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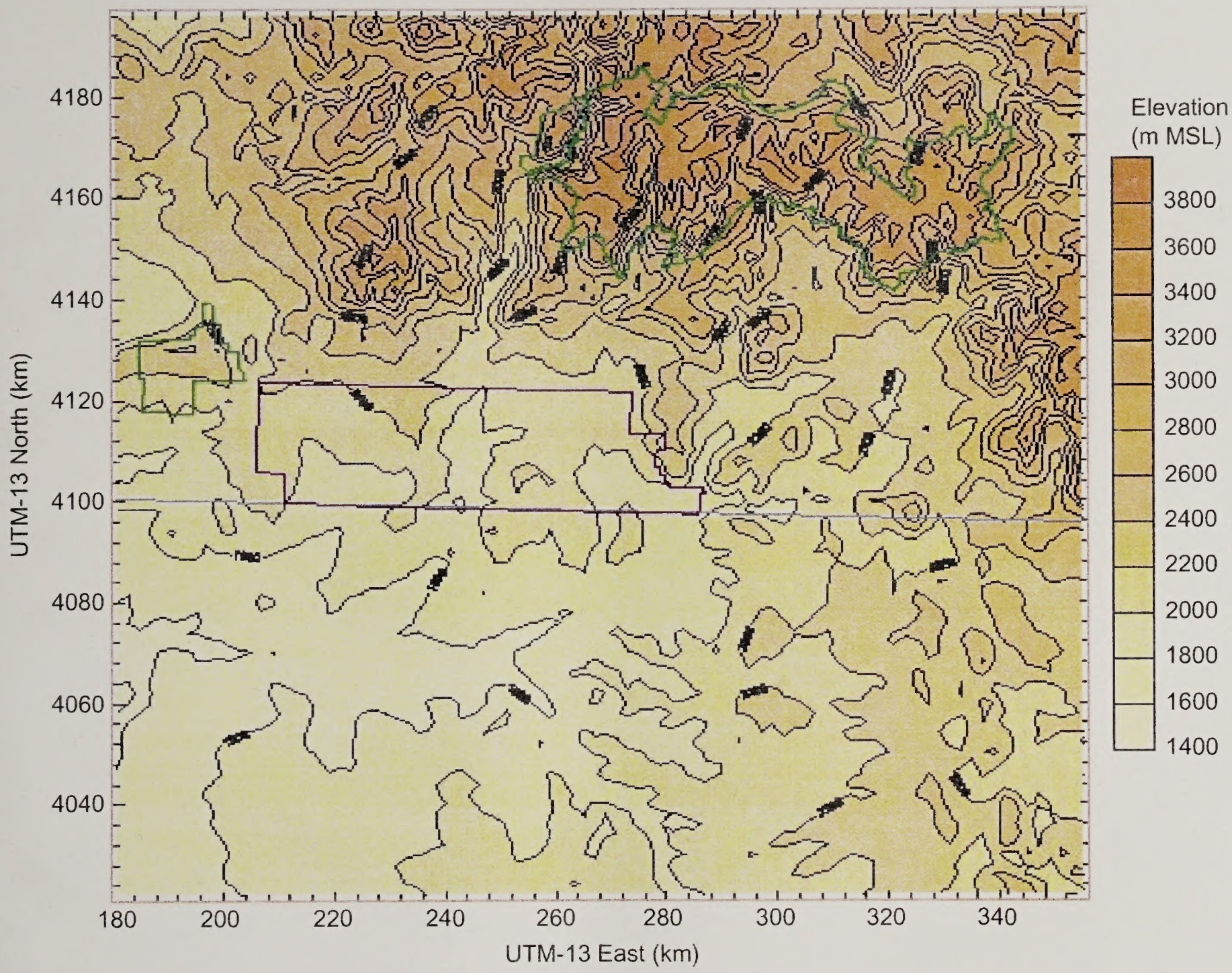
- Existing Production
- Alternative Production
- Total Production

NORTHERN SAN JUAN BASIN CBM EIS

FIGURE 3-86
PROJECTED CBM PRODUCTION IN LA PLATA COUNTY, ALTERNATIVES 1, 1A, AND 1B

ANALYSIS AREA: LA PLATA & ARCHULETA COUNTIES, COLORADO

DATE: 04.01.04	AUTOCAD FILE: 994figs.dwg
SCALE: nts	PREPARED BY: ETC



LEGEND

Federal Class I Area

NORTHERN SAN JUAN BASIN CBM EIS	
FIGURE 3-87 ***AIR QUALITY IMPACT ANALYSIS AREA***	
ANALYSIS AREA: LA PLATA & ARCHULETA COUNTIES, COLORADO	
DATE: 04.01.04	AUTOCAD FILE: 994 FIGS.DWG
SCALE: NTS	PREPARED BY: ETC

ource: RTP Environmental 2003

Chapter 4
Consultation with Others

Chapter 4 — Consultation with Others

Agencies and governmental organizations consulted by the BLM and FS as part of the EIS process include the following:

Archuleta County Commissioners

BLM — Farmington Field Office, Farmington, New Mexico

Carson National Forest

Colorado Department of Public Health and Environment (Air Pollution Control Division)

Colorado Division of Wildlife

Colorado Oil and Gas Conservation Commission

Colorado State of Engineer's Office

Hopi Tribe

Jicarilla Apache Nation

La Plata County Commissioners

National Park Service, Mesa Verde National Park

National Park Service, Washington Office

Navajo Nation

Northern Ute Tribe

Pueblo of Acoma

Pueblo of Cochiti

Pueblo of Isleta

Pueblo of Jemez

Pueblo of Laguna

Pueblo of Nambe

Pueblo of Picuris

Pueblo of Pojoaque

Pueblo of San Felipe

Pueblo of San Ildefonso

Pueblo of San Juan

Pueblo of Sandia

Pueblo of Sano Domingo

Pueblo of Santa Ana

Pueblo of Santa Clara

Pueblo of Taos

Pueblo of Tesuque

Pueblo of Zia

Southern Ute Agency

Southern Ute Indian Tribe

State of New Mexico Environment Department (Air Quality Bureau)

U.S. Environmental Protection Agency

U.S. Fish and Wildlife Service

Ute Mountain Ute Tribe

Zuni Pueblo

Chapter 5
Preparers and Contributors

Chapter 5 — Preparers and Contributors

This EIS was prepared by Greystone, a third-party contractor, under the direction of the FS and BLM. Representatives from the cooperating agencies contributed to and participated in the NEPA process. The companies provided technical input on the proposed project. The following tables present the names of individuals and their area or areas of responsibility from the BLM, FS, Greystone, Applied Hydrology Associates, Inc., BBC Research and Consulting, and Air Resources who were involved in preparing this EIS. Brief biographical information also is presented.

Table 5–1 U.S. Department of Interior, Bureau of Land Management and U.S. Department of Agriculture, National Forest Service

Name	Title	Responsibility
Jim Powers	Lands and Minerals Program Leader	Overall Document Review
Walt Brown	ID Team Leader	Overall Document Review
Dave Dallison	Timber Program Leader	Structural Diversity, Insects and Disease
Anthony Garcia	Wildlife Biologist	Management Indicator Species, Threatened, Endangered, Candidate, Sensitive Species, Biological Assessment, Biological Evaluation
Glen Raby	Geologist	Geology, Minerals, and Paleontology
Matt Janowiak	Hydrogeologist	Groundwater, Methane Seeps
Linda Farnsworth	Archaeology Program Leader	Cultural Resources
Jeff Redders	Ecologist	Soils Analysis, Vegetation, Biological Assessment, Biological Evaluation
Laura Stransky	Forestry Technician	Vegetation
Laurie Swisher	Forestry Technician	Vegetation
Gary Thrash	Land Use Planner	Planning
Rowdy Wood	Lead Rangeland Management Specialist	Range Analysis
Stephanie O'Dell	Abandoned Mine Lands/ Hazardous Materials Specialist	Hazardous Materials and Wastes
John Pecor	Petroleum Engineer	Technical Adequacy of Alternatives
Scott Archer	Senior Air Resource Specialist	Climate, Air Quality and Noise
Dave Gerhardt	Fishery Biologist	Wildlife, Fisheries, Threatened, Endangered and Special Status Species, Biological Assessment
Chris Schultz	Wildlife Biologist	Wildlife/Management Indicator Species
Kelly Palmer	Hydrologist	Surface Water, Riparian, and Wetlands

Table 5–1 U.S. Department of Interior, Bureau of Land Management and U.S. Department of Agriculture, National Forest Service

Name	Title	Responsibility
Stacy Weber	Hydrologist	Surface Water, Riparian, and Wetlands
Dick Ostergaard	Landscape Architect	Visual Resources
Richard Speegle	Outdoor Recreation Planner	Recreation Resources
Ann Bond	Public Affairs Specialist	Document Review
David Swanson	Physical Scientist	Methane Seeps and Water Monitoring
Gary Vos	Wildlife Biologist	Wildlife/Management Indicator Species
Kim Round	Landscape Architect	Visual Resources
Kristen Philbrook	Wildlife Biologist	Wildlife/Management Indicator Species
Mark Ball	Wildlife Program Leader	Wildlife/Management Indicator Species
Mike Burke	Geotechnical Engineer	Geology
Ron Klatt	Fire Management Officer	Fire Management
Bob Brantlinger	GIS Specialist	GIS Analyis

Table 5–2 Greystone — Third Party Contractor

Name	Project Responsibility	Education
Randy Schroeder	Principal	M.S. Environmental Science B.S. Natural Resource Management 27 years of experience
David Cameron	Project Manager	B.A. Biology M.S. Terrestrial Ecology 23 years of experience
Sue Barker	Surface Water Resources	B.A. Environmental Biology 11 years of experience
Kathryn Cloutier	Land Use and Socioeconomics	M.S. Environmental Management/Natural Resources B.A. Biology 15 years of experience
Claudia Young	Soils	B.S. Environmental Science 4 years of experience
Don Douglas	Noise	M.S. Meteorology B.S. Meteorology 31 years of experience
Patrick Golden	Biological Resources	B.A. Environmental Biology 7 years of experience
Jason Gregory	GIS	B.S. Natural Resource Assessment 10 years of experience
Matt Schweich	Biological Resources	B.S. Natural Resource Management 6 years of experience
Carl Späth	Cultural Resources	Ph.D. Anthropology M.A. Anthropology B.A. Anthropology 30 years of experience

Table 5–2 Greystone — Third Party Contractor

Name	Project Responsibility	Education
Lisa Welch	Transportation, Recreational Resources, and Visual Resources	B.S. Earth Science 10 years of experience
Kathy Wilkerson	Geology and Minerals	B.S. Geology 27 years of experience
Butch Fries	Technical Editor	M.A. Communication B.A. Jouranalism 27 years of experience

Table 5–3 Applied Hydrology Associates, Inc. — Subcontractor

Name	Title	Responsibility
Ian Southerland	Hydrogeologist	Groundwater Geology

Table 5–4 RTP Environmental — Subcontractor

Name	Title	Responsibility
Doug Blewitt, CCM	Air Quality Specialist	Climate and Air Quality
Mark Podrez	Air Quality Specialist	Air Quality
Thomas Swain Podrez	Air Quality Specialist	Air Quality

Table 5–5 BBC Research and Consulting — Subcontractor

Name	Title	Responsibility
Lloyd Levy	Senior Economist	IMPLAN model, Socioeconomics

Chapter 6
Distribution of the Draft EIS

Chapter 6 — Distribution of the Draft EIS

The following list identifies the agencies, organizations, companies, and persons to whom the Draft EIS was Sent.

6.1 Federal and State Officials

U.S. Senator Wayne Allard
U.S. Senator Ben Nighthorse Campbell
U.S. Representative Scott McInnis
Colorado State Representative Jim Dyer
Colorado State Representative Mark Larson

6.2 Federal Agencies

U.S. EPA, Office of Environmental Activities
U.S. EPA, Office of Federal Activities
U.S. EPA, Region VIII
USDI, Bureau of Indian Affairs
USDI, Bureau of Land Management (multiple offices)
USDI, Bureau of Reclamation
USDI, Fish and Wildlife Service
USDA, Forest Service (multiple offices)
USDI, National Park Service
USDI, Office of Environmental Policy and Compliance

6.3 State Agencies

Colorado Department of Public Health and Environment
Colorado Division of Wildlife
Colorado Historical Society SHPO
Colorado Oil and Gas Conservation Commission
Colorado State Land Board
New Mexico Environment Department

6.4 Local Agencies

Farmington Public Library
Bayfield Public Library
Durango Public Library
La Plata County Commissioners
Archuleta County Commissioners
Town of Ignacio

6.5 Tribal Organizations

Hopi Tribe
Jicarilla Apache Nation
Navajo Nation
Northern Ute Tribe
Pueblo of Acoma
Pueblo of Cochiti
Pueblo of Isleta
Pueblo of Jemez
Pueblo of Laguna
Pueblo of Nambe
Pueblo of Pojoaque
Pueblo of San Felipe
Pueblo of San Ildefonso
Pueblo of San Juan
Pueblo of Sandia
Pueblo of Santa Ana
Pueblo of Santa Clara
Pueblo of Santo Domingo
Pueblo of Taos
Pueblo of Tesuque
Pueblo of Zia
Puebo of Picuris
Southern Ute Agency
Southern Ute Indian Tribe
Ute Mountain Ute Tribe
Zuni Pueblo

6.6 Organizations

Colorado Oil and Gas Association
Joseph B. Gould Trust
La Plata County Energy Council
Land and Water Fund of the Rockies
San Juan Citizens Alliance
San Juan Trail Riders

6.7 Companies

Animas Steel Supply
Apache Corporation
Benson, Montin, Greer Corp.
Bjork, Lindley, Danielson & Litlle, P.C.
Black Hills E&P
BP America
CDX Rockies, LLC
Central Resources Incorporated
Chevron Texaco
Daub and Associates
Dugan Production Corp.
Elm Ridge Resources
EXOK, Inc.
Gosney and Sons
J.M. Huber Corporation
Kinder-Morgan CO2 Company
MAF, Inc.
Maxim Technologies
McDaniel, Baty, and Miller, LLC
Merrion Oil and Gas Corporation
Oklahoma Silurian Partners
Pablo Operating Company
Petrox Resources, Inc.
Pinnacle Producing Properties, Inc.
Pure Resources
Questar Energy Company
Red Willow Production Company
SG Interests, Inc.
Sugnet Environmental, Inc.
T.H. McElvian Oil and Gas Ltd.
Terra Exploration and Production Co.

Timberland Land Corp.
Trigon-Sheehan, LLC
U.S. Oil and Gas Inc.
Universal Resources Corporation
Vernon E. Faulconer, Inc.
XTO Energy, Inc.

6.8 Educational Institutions

Colorado School of Mines

6.9 Individuals

Ancell, J.
Annala, L.
Barr, D. and M.
Baumgardt, J. and E.
Beck, K.
Bell, R.
Blaisdell, J.
Brinker, D.
Bryson, P.
Burkett, R. and M.
Byers, D.
Caldwell, C.
Celmontoni, P.
Christensen, C. and W.
Click, S.
Cohen, O.
Copeland, F. and M.
Corley, E. and P.
Corwin, D.
Cullipher, R.
Cummins, P.
Dalen, R.
Davies, S.
Delzell, B.
Doskocil, J.
Dressen, E.
Dressen, P.
Eaglin, S. and D.

Earl, C.
Edwards, S.
Englander, M.
Englishman, D.
Filler, S.
Fleener, J.
Ford, W.
Fosnot, J.
Franzheim, S.
Fry, H.
Gagnon, J.
Gilmore, D.
Gurholt, S.
Hagan, H.
Hanes, H.
Harvey, J. and S.
Henely, M. and J.
Herrboldt, H.
Hoffman, B.
Holden, M.
Holland, W.
Holmes, O.
Horn, B.
Johnson, L.
Jordan, S.
Kedrowski, P.
Kloster, C.
Knoll, B.
Krest, S.
LaBonte, E.
Landgren, R.
Latshaw, C.
Libby, S.
Lochte, M.
Lutes, T.
Magoon, R.
Markham, C.
McCracken, B.
McGee, L.
McWilliams, C.
Messier, K. and R.

Miller, B.
Miller, S.
Milliet, C.
Morales, E.
Nylund, E. and E.A.
O'Hare, M.
Owens, A.
Paul, K.
Pendery, B.
Piccoli, F.
Pierson, E.
Piqué, T.
Poliquin, D.
Repert, V.
Rich, D.
Schmidt, S.
Senti, N. and N.
Shaw, A.
Shelton, T. and L.
Snyder, B.
Solomon, D.
Speer, D.
Stengle, C.
Stephenson, J.
Stewart, J.
Tate, S. and P.R.K.
Taylor, B.
Taylor, T.
Temple, D. and P.
Thomas, C. and M.B.
Thurston, W.
Timmerman, C.
Turgeon, L.
Van Lindt, C.
Wagner, R.
Warfield, L.
Whitehead, N.
Wickman, B.
Zartner, K.

Chapter 7
Glossary

Chapter 7 — Glossary

Acid Neutralizing Capacity – The extent to which natural water bodies are able to buffer atmospheric deposition of sulfate and/or nitrate particulate matter from air pollution emission sources.

Acre-feet – The volume of liquid or solid required to cover one acre to a depth of one foot, or 43,560 cubic feet; measure for volumes of water, reservoir rock, etc.

Adsorb – A process by which molecules are taken up on the surface of a solid by chemical or physical action. Large amounts of gases, for example, may be adsorbed on the surface of a porous material such as charcoal.

Ad valorem – A tax on items that is imposed at a rate percent of value.

Affected Environment – The natural, physical, and human-related environment that is sensitive to changes due to proposed actions; the environment under the administration of a land management agency.

Air Dispersion Modeling – A complex computer model that calculates ambient concentrations of air pollutants.

Allotment – A unit of land suitable and available for livestock grazing that is managed as one grazing unit.

Alluvial – Deposited by a stream.

Alluvial Fan – A fan-shaped deposit of unsorted stream sand and gravel located where an ephemeral stream issues from a relatively steep mountain valley on to a relatively flat plain.

Alluvial Valley – A valley containing stream-deposited silt, sand, and gravel.

Alluvium – Unconsolidated or poorly consolidated gravel sands and clays, deposited by streams and rivers on riverbeds, floodplains, and alluvial fans.

Ambient – The environment as it exists at the point of measurement and against which changes or impacts are measured.

Ambient Concentration – The mass of a pollutant in a given volume of air. It is typically measured as micrograms of pollutant per cubic meter of air.

Ancillary Facility – Additional support structures required to develop the mineral resource. In the case of CBM development, this consists of gas compressor facilities, roads, collection pipelines, and electric power lines.

Animal Month – for cow/calf operations, it is the amount of forage consumed by a 1,000-pound cow and calf (less than 6 months of age) over a one-month period. It is approximately 1,050 pounds of forage.

Annulus – The space between the well casing and the boundary of the hole.

Antiquities – A general term for archaeological or paleontological resources that are at least 100 years of age and that tangibly represent or have the potential to yield information on historical or prehistoric cultures, or extinct plants and animals.

Aquifer – A body of rock that is sufficiently permeable to conduct groundwater and to yield economically significant quantities of water to wells and springs.

Assemblage – A group of rocks grouped together by age or similar origin.

Authorizing Officer – Person designated by an Agency as being in the position to speak for and commit the agency to action.

Avoidance Area – An environmentally sensitive area designated by an Agency. Authorizations would be granted only in cases where there is a prevailing need and no practical alternative exists, and then only with provisions to protect the sensitive resources.

Azimuth – Horizontal direction expressed as the angular distance between the direction of a fixed point and the direction of the object.

Background – The viewing area of a distance zone that lies beyond the foreground-middleground. Usually from a minimum of 3 to 5 miles to a maximum of about 15 miles from a travel route, use area, or other observer position. Atmospheric conditions in some areas may limit the maximum to about 8 miles or increase it beyond 15 miles.

Best Management Practices – a practice or combination of practices determined by the state to be the most effective and practicable (including technological, economic and institutional considerations) means of preventing or reducing the amount of pollution generated by non-point sources to a level compatible with water quality goals.

Big Game – Large species of wildlife that are managed for hunting.

Biotic – Pertaining to life and living organisms.

Blow Out Prevention Equipment – A series of valves on the drill rig that can close down the well in the event that the drill bit penetrates extreme pressure zones.

Bond – Financial guarantee to ensure compliance with the Mineral Leasing Act, including complete and timely plugging of wells, reclamation of lands or adversely affected surface waters, payment of royalties, assessments, or penalties.

Broadcast Seeding – Distribution of seed by a fan spreader or by hand spreading.

Canopy – The more-or-less continuous cover of branches and foliage formed collectively by the crown of adjacent trees and other woody growth.

Carbon Dioxide (CO_2) – A non-hydrocarbon, corrosive gas that occurs naturally in the gaseous phase in the natural gas reservoir, or is injected into the reservoir in connection with pressure maintenance, gas cycling, or other secondary or enhanced recovery projects.

Casing – (N) A steel pipe that maintains the opening of a drill hole. (V) The act of installing pipe within a well.

Catalyst – A substance that enables a chemical reaction to proceed at a usually faster rate or under different conditions than otherwise possible.

Cation – A positive ion, which in electrolysis, travels to the cathode and is discharged there.

Cement Bond Log – A geophysical log which confirms the continuous placement of cement within the annulus of the well, to isolate the formation of interest and to prevent commingling of different aquifers around the casing.

Characteristic Landscape – The established landscape within an area being viewed. The term does not necessarily mean a naturalistic character, but may refer to features of the cultural landscape, such as a farming community, an urban landscape, or other landscape that has an identifiable character.

Clean Air Act – Public Law 84–159, established July 14, 1955, and amended numerous times since. The Clean Air Act: establishes Federal standards for air pollutants emitted from stationary and mobile sources; authorizes states, tribes and local agencies to regulate polluting emissions; requires those agencies to improve air quality in areas of the country which do not meet Federal standards; and to prevent significant deterioration in areas where air quality is cleaner than those standards. The Act also requires that all Federal activities (either direct or authorized) comply with applicable local, state, tribal and Federal air quality laws, statutes, regulations, standards and implementation plans. In addition, before these activities can take place in non-attainment or maintenance areas, the Federal agencies must conduct a Conformity Analysis (and possible Determination) demonstrating the proposed activity will comply with all applicable air quality requirements.

Climatology – Science of climate and its causes.

Coal bed – A seam or stratum of coal parallel to the rock stratification.

CFR – Code of Federal Regulations, the compilation of federal regulations adopted by federal agencies through a rule-making process.

Colluvial – Consisting of a mixture of soil and angular fragments of rock that have accumulated at the foot and on slopes of mountainsides under the influence of gravity.

Colluvium – A mixture of soil and angular fragments of rock that have accumulated at the foot and on slopes of mountainsides under the influence of gravity.

Community (plant community) – An assembly of plants living together, reflecting no particular ecological status.

Community Types (vegetation) – A group of plants living in a specific region under relatively similar conditions.

Compressor – Equipment (electrically or gas-driven) used to increase the pressure on the produced gas to move it into transmission lines or into storage.

Conglomerate – A sedimentary rock comprised of an unstratified mixture or stratified layers of cobbles, gravel, and sand.

Coniferous – Referring to a cone-bearing, usually evergreen, tree.

Contrast – The effect of a striking difference in the form, line, color, or texture of the landscape features within the area being viewed.

Criteria Pollutants – Air pollutants for which the EPA has established State and National Ambient Air Quality Standards. These include particulate matter (PM_{10}), nitrogen oxides (NOx), sulfur dioxide (SO_2), carbon monoxide (CO), and volatile organic compounds (VOC).

Cubic Foot – The volume of gas contained in one cubic foot of space at a standard pressure base of 14.7 psia and a standard temperature base of 60 degrees Fahrenheit.

Cultural Resources – The archaeological and historical remains of human occupation or use. Includes any manufactured objects, such as tools or buildings. May also include objects, sites, or geological/geographical locations significant to Native Americans.

Cultural Significance – Is embodied in those qualities of prehistoric or historic districts, sites, buildings, structures, or objects that meet the National Register Criteria for Evaluation (36CFR60.4). The application of these criteria is explained in the National Register Bulletin 15, distributed by the National Park Service.

Cuestas – A sloping plain that is terminated on one side by a steep slope.

Cumulative Effects – As defined by 40 CFR 1508.7, cumulative effects are the impacts on the environment which result from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions, regardless of what agency or person undertakes such other actions. Cumulative effects can result from individually minor but collectively significant actions taking place over a period of time.

dBA – The sound pressure levels in decibels measured with a frequency weighing network corresponding to the A-scale on a standard sound level meter. The A-scale tends to suppress lower frequencies, e.g., below 1,000 Hz.

Decibels (dBA) – Units for describing amplitude of sound frequencies to which the human ear is sensitive.

Deciduous – Trees or shrubs that lose their leaves each year during a cold or dry season.

Decommissioning – Generally, the removal of a facility or piece of equipment from service, or a change in status from active to inactive.

Demographic – Pertaining to the study of human population characteristics including size, growth rates, density, distribution, migration, birth rates, and mortality rates.

Desorb – To restore an adsorbed substance.

Direct Effects – As defined by 40 CFR 1508.9, these are effects that are caused by the action and occur at the same time and place as the action. Synonymous with direct impacts.

Direct Impact Area – An area analyzed for the effects of an action that would occur at the same place in time.

Discharge – The volume of water flowing past a point per unit time, commonly expressed as cubic feet per second (cfs), gallons per minute (gpm), or million gallons per day (mgd).

Dispersed Recreation – A general term referring to recreation use outside the developed recreation sites. This includes activities such as scenic driving, hunting, hiking, OHV use, and biking.

Distance Zones – Areas of landscapes denoted by specified distances from the observer. Used as a frame of reference in which to discuss landscape characteristics or activities of man.

- Background (bg) – Area located from 3–5 miles to infinity from viewer.
- Middleground (mg) – Area located from 0.25–0.50 to 3–5 miles from the viewer.
- Foreground (fg) – The detailed landscape found within 0 to 0.25–0.50 mile from the viewer.

Disturbance – An event that changes the local environment by removing organisms or opening up an area, facilitating colonization by new, often different, organisms.

Disturbed Area – Area where natural vegetation and soils have been removed or disrupted.

Diversity – The distribution and abundance of different plant and animal communities and species within the area covered by a Land and Resource Management Plan.

Drainage – Natural channel through which water flows some time of the year. Natural and artificial means for effecting discharge of water as by a system of surface and subsurface passages.

Drill Bit – The cutting devise used to drill a well. It is typically made of hardened steel, and may have industrial grade diamond components.

Drilling Mud – The circulating fluid used to bring cuttings out of the well bore, cool the drill bit, and provide hole stability and pressure control. Drilling mud includes a number of additives to maintain the mud at desired viscosities and weights. Some additives that may be used are caustic, toxic, or acidic.

Earthquake – Sudden movement of the earth's crust resulting from faulting, volcanism, or other mechanisms.

Ecosystem – An interacting system of organisms considered together with their environment for example, marsh, watershed, and stream ecosystems.

Ecotone – The boundary or transition zone between adjacent plant communities, often delineating different habitat types.

Effects – Environmental consequences as a result of a proposed or alternative action. Included are direct effects, which are caused by the action and occur at the same time and place, and indirect effects, which are caused by the action and are later in time or further removed in distance but which are still reasonably foreseeable. Also referred to as impacts.

Endangered Species – Any species of animal or plant which is in danger of extinction throughout all or significant portions of its range and has been designated "endangered" in the Federal Register by the Secretary of the Interior. Disturbance of the habitat of endangered species is prohibited by the Endangered Species Act of 1973, as amended.

Endemic – Confined naturally to a particular geographic area. Often used in opposition to the word epidemic.

Environment – The aggregate of physical, biological, economic, and social factors affecting organisms in an area.

Environmental Analysis – An analysis of alternative actions and their predictable environmental effects, including physical, biological, economic, and social consequences and their interactions; short- and long-term effects; direct, indirect, and cumulative effects.

Environmental Assessment – A concise public document which serves to (a) Briefly provide sufficient evidence and analysis for determining whether to prepare an EIS or a Finding of No Significant Impact; (b) Aid an agency's compliance with NEPA when no EIS is necessary; (c) Facilitate preparation of an EIS when necessary.

Environmental Impact Statement – An analysis of alternative actions and their predictable environmental effects, including physical, biological, economic, and social consequences and their interactions; short- and long-term effects; direct, indirect, and cumulative effects.

Environmental Justice – Executive Order 12898 (February 11, 1994) mandates Federal agencies to identify and address disproportionately high and adverse human health or environmental effects of its programs, policies, and activities on minority and low-income populations.

Ephemeral Drainage – A drainage area or a stream that has no base flow. Water flows for a short time each year but only in direct response to rainfall or snowmelt events.

Emission – Air pollution discharge into the atmosphere, usually specified by mass per unit time.

Erosion – Detachment or movement of soil or rock fragments by water, wind, ice, or gravity. Accelerated erosion is much more rapid than normal, natural or geologic erosion, primarily as a result of the influence of activities of man, animals, or natural catastrophes.

Exploration – The search for economic deposits of minerals, ore, and other materials through practices of geology, geochemistry, geophysics, drilling, and/or mapping.

Fault – A fracture in bedrock along which there has been vertical and/or horizontal movement caused by differential forces in the earth's crust.

Faulting – Relative displacement of adjacent bedrock along a fracture.

Fisheries – Streams and lakes used for fishing.

Fisheries Habitat – streams, lakes, and reservoirs that support fish.

Flaring – The controlled ignition of natural gas at a wellhead.

Floodplain – That portion of a river valley, adjacent to the channel, which is built of recently deposited sediments and is covered with water when the river overflows its banks at flood stages.

Fluvial – Comprehensive term for river processes.

Footprint – The actual surface area physically disturbed by oil and gas operations and ancillary facilities.

Forage – Vegetation used for food by wildlife, particularly big game wildlife and domestic livestock.

Forb – A broad-leaved flowering plant.

Foreground-Middleground – The area visible from a travel route, use area, or other observer position to a distance of 3 to 5 miles. The outer boundary of this zone is defined as the point where the texture and form of individual plants are no longer apparent in the landscape, and vegetation is apparent only in pattern or outline.

Fracturing – A method of stimulating well production by increasing the permeability of the producing formation. Fracture fluids, which include propping agents such as, sand or glass beads, are pumped into the formations under extremely high hydraulic pressure. The propping agents facilitate the formation of channels to release water and gas into well.

Fugitive Dust – Airborne particles emitted from any source other than through a controllable stack or vent.

Game Species – Animals commonly hunted for food or sport.

Gas Venting – The release of gas into the atmosphere following well development and before successful installation of the collection pipeline system.

Geotechnical – A branch of engineering concerned with the engineering design aspects of slope stability, settlement, earth pressures, bearing capacity, seepage control, and erosion.

Glacial Outwash – The material deposited by streams flowing within a glacier and by melt-waters during times of glacial advance and retreat.

Grade – A slope stated in terms of feet per mile or as feet per feet (percent); the content of precious metals per volume of rock (ounces per ton).

Groundwater – All subsurface water, especially that as distinct from surface water portion in the zone of saturation.

Habitat – The place or type of site where a plant or animal naturally or normally lives and grows. Includes all biotic, climatic, and soils conditions, or other environmental influences affecting living conditions.

Habitat Diversity – the distribution and abundance of different plant and animal communities and species within a specific area.

Habitat Fragmentation – The process by which habitats are increasingly subdivided into smaller units, resulting in their increased isolation as well as loss of total habitat area.

Habitat Type – The aggregate of all areas that support or can support the same primary vegetation at climax.

Herbaceous – The plant strata which contain soft, not woody, stemmed plants that die to the ground in winter.

Historic Landscape – A type of historic district that is a geographic area, or the sites, buildings, structures, natural and cultural features, and objects within a defined geographic area, that together, represents a defined historic or prehistoric theme and period. The definition of a historic landscape includes: (1) a significant theme (linkage or continuity) such as a particular economic activity or ethnic group, (2) definitions of those sites, buildings, structures, natural features, cultural landscape modifications, and objects (property types) which represent the theme, and (3) a cultural period or date range.

Hydrogen Sulfide (H_2S) – A flammable, poisonous, corrosive gas with an odor suggestive of rotten eggs, which can occur naturally in the gaseous phase in natural gas reservoirs.

Hydrology – A science that deals with the properties, distribution, and circulation of surface and subsurface water.

Hydrostatic Testing – Testing of the integrity of a newly placed, but uncovered pipeline for leaks. The pipeline is filled with water and pressurized to operating pressures, and the pipeline is visually inspected.

Impoundment – The accumulation of any form of water in a reservoir or other storage area.

Indemnify – To secure against, or to provide compensation for incurred loss, hurt, or damage.

Indirect Effects – As defined by 40 CFR 1508.8, these are effects which are caused by the action but occur later in time or are removed in distance from the action, but are still reasonably foreseeable. Synonymous with indirect impacts.

Infiltration – The movement of water or some other liquid into the soil or rock through pores or other openings.

Infrastructure – The basic framework or underlying foundation of a community including road networks, electric and gas distribution, water and sanitation services, and facilities.

Injection Well – Any well used for the disposal or air, gas, water or other substance into any underground stratum.

Intermittent Stream – A stream that flows only at certain times of the year when it receives water from alluvial ground water, springs, or from some surface source such as melting snow in mountainous areas.

Irretrievable – Applies to the loss of production, harvest, or use of natural resources. For example, some or all of the timber production from an area is lost irretrievably while an area is serving as a winter sports site. The production lost is irretrievable, but the action is not irreversible. If the use changes, it is possible to resume timber production.

Irreversible – Applies primarily to the use of nonrenewable resources, such as minerals or cultural resources, or to those factors that are renewable only over long time spans, such as soil productivity and aspen regeneration. Irreversible also includes loss of future options.

Landform – Any physical, recognizable form or feature of the Earth's surface, having a characteristic shape and produced by natural causes. Includes major features such as plains, plateaus, and mountains, and minor features, such as hills, valleys, slopes, canyons, arroyos, and alluvial fans.

Landscape Character – The arrangement of a particular landscape as formed by the variety and intensity of the landscape features as defined as the four basic elements (form, line, color, and texture). These factors give the area a distinctive quality that distinguishes it from its immediate surroundings.

Landslide – A perceptible downhill sliding or falling of a mass of soil and rock lubricated by moisture or snow.

Land Use – Land uses determined for a given area that establish the types of activities allowed (e.g., mining, agriculture, timber production, residential, industrial).

Lease – Any contract, profit-share arrangement, joint venture or other agreement issued or approved by the United States under a mineral leasing law that authorizes exploration for, extraction of or removal of oil or gas.

Lek – An area used by sage grouse for mating displays (strutting ground).

Lithic Scatter – Is a surface scatter of cultural artifacts and debris that consists entirely of lithic (i.e., stone) tools and chipped stone debris. This is a common prehistoric site type that is contrasted to a cultural material scatter, which contains other or additional artifact types such as pottery or bone artifacts, to a camp which contains habitation features, such as hearths, storage features or occupation features, or to other site types that contain different artifacts or features.

Loam – A mixture of sand, silt, and clay containing between 7 and 27 percent clay, 28 to 50 percent silt, and less than 50 percent sand.

Locus – Is a discrete place or physical location generally used in describing the qualities of a site. When the term is used in contrast to a site, it refers to a locality containing the traces of a brief, limited or transient cultural activity.

Long-Term Impacts – For the purpose of the Powder River Oil and Gas NEPA analysis, long-term effects generally last beyond the construction period.

Macroinvertebrates – Aquatic invertebrate animals that live on or in the surface of the substrate of streams or lakes.

Management Area – an area composed of aggregate pieces of land (generally several to many analysis areas) to which a given management objective and prescriptions are applied.

Management Direction – a statement of multiple use and other goals and objectives, along with the associated management prescriptions and standards and guidelines to direct resource management.

Median – A value in an ordered set of values above and below which there are an equal number of other values.

Mesic – A habitat characterized by moderate moisture and temperature conditions and by a profusion of plant life.

Methane (CH_4) – The simplest hydrocarbon; natural gas is nearly pure methane.

Mitigate – To lessen the severity.

Mitigation – Actions to avoid, minimize, reduce, eliminate, or rectify the impact of a management practice.

Modified Mercalli Intensity Scale – A qualitative measurement scale describing the intensity (degree of shaking) felt by people, structures, and the ground. Intensities range from I (felt by few, if any, people) to XII (damage total).

Monitor – To systematically and repeatedly watch, observe, or measure environmental conditions in order to track changes.

Monoculture – An area characterized by the vegetation consisting of a single species, e.g. a wheat field.

Mottled – Marked by different shaded spots.

National Ambient Air Quality Standards (NAAQS) – The allowable concentrations of air pollutants in the air specified by the Federal government. The air quality standards are divided into primary standards (based on the air quality criteria and allowing an adequate margin of safety and requisite to protect the public health) and secondary standards (based on the air quality criteria and allowing an adequate margin of safety and requisite to protect the public welfare from any unknown or expected adverse effects of air pollutants).

National Register of Historic Places – A list, maintained by the National Park Service, of areas which have been designated as being of historical significance.

Native Species – Plants that originated in the area in which they are found, i.e., they naturally occur in that area.

Natural Gas – Those hydrocarbons, other than oil and other than natural gas liquids separated from natural gas, that occur naturally in the gaseous phase in the reservoir and are produced and recovered at the wellhead in gaseous from. Natural gas includes coal bed methane gas.

National Environmental Policy Act – The National Environmental Policy Act of 1969. It is the national charter for protection of the environment. NEPA establishes policy, sets goals, and provides means for carrying out the policy. Regulations at 40 CFR 1500–1508 implement the act.

Nesting Substrate – The site on which a nest is placed such as a tree, cliff, or ground.

Noxious Weeds – An alien, introduced, or exotic undesirable species that is aggressive and overly competitive with more desirable native species.

Ozone – A molecule containing three oxygen atoms (O_3) produced by passage of an electrical spark through air or oxygen (O_2).

Pan Evaporation – a measurement of water loss to the atmosphere from a standard evaporation pan with a diameter of 47.5 inches and a depth of 10 inches.

Paleontology – The science that deals with the history and evolution of life on earth.

Particulate Matter – A particle of soil or liquid matter (e.g., soot, dust, aerosols, fumes and mist).

Passerine – A taxonomic order that includes perching birds and songbirds.

Peak Flow – The greatest flow attained during melting of winter snowpack or during a large precipitation event.

Perennial – A plant whose life cycle lasts longer than two years. The tops of herbaceous perennials die down at the end of the growing season, buds, roots, and underground portions persist.

Perennial Stream – A stream or reach of a stream that flows throughout the year.

Permeability – The capacity of a soil or groundwater aquifer to transmit water.

Permeable – The property or capacity of a porous rock, sediment, or soil to transmit a liquid.

pH – The negative $\log_{10}$ of the hydrogen ion activity in solution; a measure of acidity or basicity of a solution.

Physiographic – Pertaining to the genesis and evolution of landforms.

PM_{10} – Airborne suspended particles with an aerodynamic diameter of 10 microns or less.

Porosity – The voids or openings in geological materials.

Potentiometric surface – A surface that represents the total head in an aquifer; it represents the height at which the water level stands in tightly cased wells that penetrate the aquifer.

Prevention of Significant Deterioration (PSD) – A regulatory program under the Clean Air Act (Public Law 84-159, as amended) to limit air quality degradation in areas currently achieving the National Ambient Air Quality Standards. The PSD program established air quality classes in which differing amounts of additional air pollution is allowed above a legally defined baseline level. Almost any additional air pollution would be considered significant in PSD Class I areas (certain large national parks and wilderness areas in existence on August 7, 1977, and specific Tribal lands redesignated since then.) PSD Class II areas allow that deterioration associated with moderate, well-controlled growth (most of the country). Although Class III areas would allow greater incremental impacts planned individual growth, no Class III areas have been established.

Produced Water – Formation water pumped during the development of a gas well.

Productivity – In reference to vegetation, productivity is the measure of live and dead accumulated plant materials.

Range – Land producing native forage for animal consumption and lands that are revegetated naturally or artificially to provide forage cover that is managed like native vegetation, which are amenable to certain range management principles or practices.

Raptor – A bird of prey with sharp talons and strongly curved beaks, which preys on living animals (e.g., eagles, hawks, falcons, and owls).

Recharge – Replenishment of the water supply in an aquifer through the outcrop or along fracture lines.

Reclamation – The process of restoring disturbed areas using any of several methods, recontouring, spreading topsoil or growth medium, seeding, and planting, among others.

Recontouring – Restoration of the natural topographic contours by reclamation measures, particularly in reference to roads.

Record of Decision – A decision document for an Environmental Impact Statement or Supplemental EIS that publicly and officially discloses the responsible official's decision regarding the actions proposed in the Environmental Impact Statement and their implementation.

Recreation Opportunity Spectrum Settings – A system of measuring the land's ability to meet the expectations of recreation users. Six recreation categories, from primitive (natural) to urban (highly modified) describe the activities, settings, and experiences an area offers. The following categories may be found in or near the analysis area:

- Urban – a highly modified environment, although the background may have natural elements. Sights and sounds of man predominate, and large numbers of users can be expected.
- Rural – an area characterized by the sights and sounds of rural residential and agricultural land uses. The interaction between users is often moderate to high.
- Roaded Natural – a road corridor with a landscape that is characterized as natural or natural appearing. The road has moderate to high use.
- Semi-Primitive Motorized – a natural area predominantly unmodified by man. There are opportunities for isolation from the sights and sounds of man, but occasional evidence of other area users.

Recreation Visitor Day – A measurement equivalent to one person recreating for 12 hours or several people for a total of 12 hours.

Reserve Pit – A pit prepared on a well pad before drilling to use for wastewater retention, evaporation, and disposal. Wastewaters will have a fine solids component.

Reserves – Identified resources of mineral-bearing rock from which the mineral can be extracted profitably with existing technology and under present economic conditions.

Residuum – Unconsolidated material that accumulates by weathering of parent material in place.

Resources (geologic) – Reserves plus all other mineral deposits that may eventually become available – either known deposits that are not recoverable at present, or unknown deposits, that may be inferred to exist but have not yet been discovered.

Riffle – A shallow section of stream with rapid current and a surface broken by gravel, rubble, or boulders.

Rights-of-Way – An accurately located strip of land with defined width, point of beginning, and point of ending. It is the area within which the user has authority to conduct operations approved or granted by the landowner in an authorizing document, such as a permit, easement, lease, license, or Memorandum of Understanding.

Riparian – Land areas that are directly influenced by water. They usually have visible vegetative or physical characteristics showing this water influence. Streamsides, lake borders, or marshes are typical riparian areas.

Riparian Ecosystem – a transition between the aquatic ecosystem and adjacent upland terrestrial ecosystem; identified by soil characteristics and distinctive vegetation communities that require free or unbounded water.

Rockfall – Rapid fall of a detached piece of bedrock from a cliff or steep slope.

Roosting – To rest or sleep in a roost. A bird will typically use the same roost over an extended period of time.

Runoff – That part of precipitation that appears in surface streams. Precipitation that is not retained on the site where it falls and is not absorbed by the soil.

Salmonidae – A family of fish that includes salmon and trout.

Salmonid Spawning Areas – Waters that provide or could provide a habitat for active self-propagating populations of salmonid fishes.

Scatter (archeological) – Random evidence of prior disturbance that is distributed about an area rather than concentrated in a single location.

Scoping – Procedures by which agencies determine the extent of analysis necessary for a proposed action, (i.e., the range of actions, alternatives, and impacts to be addressed; identification of significant issues related to a proposed action; and the depth of environmental analysis, data, and task assignments needed).

Sedge – Plants that resemble grasses but have hollow rather than woody stems.

Sediment – Soil or rock particles that have been transported to stream channels or other bodies of water. Sediment input comes from natural sources, such as soil erosion, rock weathering, agricultural practices, or construction activities.

Sediment Load – The amount of sediment (sand, silt, and fine particles) carried by a stream or river.

Sedimentary – Rock formed from fragments of pre-existing rocks (e.g. sandstone) or by precipitation from solution (e.g. limestone).

Seedling – Newly germinated plants.

Seismic – Pertaining to or produced by earthquakes.

Sensitive Species – Those species of plants or animals that have appeared in the Federal Register as proposed for classification and are under consideration for official listing as endangered or threatened species under the Endangered Species Act. This also includes species that are on an official state list or are recognized by the Land Manager as needing special management to prevent their being placed on federal or state lists.

Sensitivity Level – a particular degree or measure of viewer interest in the scenic qualities of the landscape.

- Sensitivity Level 1 – The highest sensitivity level, referring to areas seen from travel routes and use areas with moderate to high use.
- Sensitivity Level 2 – An average sensitivity level, referring to areas seen from travel routes and use areas with low to moderate use.
- Sensitivity Level 3 – The lowest sensitivity level, referring to areas seen from travel routes and use with low use.

Short-Term Impacts – For the purpose of the Powder River Basin Oil and Gas NEPA analysis, short-term impacts are generally defined as those that would occur during the construction period.

Shut In – Refers to a well that is completed, is shown to be capable of production in paying quantities, and is not presently being operated.

Significant – As used in NEPA determination of significance requires consideration of both context and intensity. Context means that the significance of an action must be analyzed in several contexts such as society as a whole, and the affected region, interests, and locality. Intensity refers to the severity of impacts (40 CFR 1508.27).

Slump – Slide or earthflow of a soil mass.

Soil – Loose, unconsolidated surface material comprising topsoil and subsoil.

Spawning – The deposition of eggs and sperm by fish.

Species – Organisms that successfully reproduce among themselves and cannot reproduce successfully with other organisms.

Species of Special Concern – A native species whose population is low and limited in distribution or has suffered significant reductions because of habitat loss.

Specific Conductance (umhos/cm) – A measure of electrical conductivity in water that is influenced by the mineral content of the water.

Stormwater Runoff – Overland runoff from snowmelt or a precipitation event.

Strata – An identifiable layer of bedrock or sediment; does not imply a particular thickness of rock.

Substrate – Material consisting of silts, sands, gravels, boulder and woody debris found on the bottom of a stream channel.

Target formation – The geological association of rocks that contain the exploitable mineral reserves.

Telemetry – Instrumentation to transmit scientific equipment readings from remote locations to a central site.

Threatened Species – Any species of animal or plant which is likely to become endangered within the foreseeable future throughout all or significant portions of its range. It has been designated in the Federal Register by the Secretary of the Interior as a threatened species. Disturbance of the habitat of threatened species is prohibited by the Endangered Species Act of 1973, as amended.

Thrust Faulting – Low angle fracturing of bedrock in response to horizontal stress within the earth's crust

Total Dissolved Solids – Total amount of dissolved material, organic or inorganic, contained in a sample of water.

Total Suspended Soils – Amount of undissolved particles suspended in liquid.

Transmissivity – The rate at which water is transmitted through a unit width of a groundwater aquifer or confining bed under a unit hydraulic gradient.

Turbidity – A fisheries measurement of the total suspended solids in water expressed as nephelometric turbidity units (NTU).

Understory – The trees and other woody species growing under a more-or-less continuous cover of branches and foliage formed collectively by the upper portion of adjacent trees and other woody growth.

Variety Class – a particular level of visual variety or diversity of landscape character. There are three variety classes; A, B, and C.

- Variety Class A – distinctive
- Variety Class B – common
- Variety Class C – minimal

Vegetation – All of the plants growing in and characterizing a specific area or region; the combination of different plant communities found there.

Visual Resource – The composite of basic terrain, geologic features, water features, vegetation patterns, and land use effects that typify a land unit and influence the visual appeal the unit may have for viewers.

Visual Resource Management System – The BLM system for evaluating and classifying visual resources. The system uses line, form, color, texture, scale and space to categorize lands into one of four classes:

- Class I. Preservation
- Class II. Retention
- Class III. Partial Retention
- Class IV. Modification

Water Quality – refers to a set of chemical, physical, or biological characteristics that describe the condition of a river, stream, or lake. The quality of water determines which beneficial uses it can support. Different instream conditions or levels of water quality are needed to support different beneficial uses.

Waters of the United States – A jurisdictional term from Section 404 of the Clean Water Act referring to water bodies such as lakes, rivers, streams (including intermittent streams), mudflats, sandflats, wetlands, sloughs, prairie potholes, wet meadows, playa lakes, or natural ponds, the use, degradation, or destruction of which could affect interstate or foreign commerce.

Watershed – All of the land that drains surface water to a given stream above a designated point (usually its mouth); also called a stream drainage or drainage basin.

Well Head – The equipment used to maintain surface control of a well. It is composed of the casing head, tubing head and a series of valves and fittings.

Well Pad – A level area constructed for the purpose of drilling a well.

Wetlands – Areas that are inundated by surface or groundwater with a frequency sufficient to support and under normal circumstances does or would support a prevalence of vegetation or aquatic life that requires saturated or seasonally saturated soil conditions for growth and reproduction.

Winter Range – The place where migratory (and sometimes non-migratory) animals congregate during the winter season.

Workover – Well maintenance activities that require onsite mobilization of a drill rig to repair the well bore equipment (casing, tubing, rods, or pumps) or the wellhead. In some cases, a workover may involve development activities to improve production from the target formation.

Chapter 8
References Cited

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Appendix A

Forest Service and Bureau of Land Management Surface Use Requirements

Appendix A — Forest Service and Bureau of Land Management Surface Use Requirements

FOREST SERVICE SURFACE USE PLAN OF OPERATION

(well site name)

In addition to the terms of the lease, the following surface occupancy requirements will apply:

I. ADMINISTRATION

A. All construction and routine heavy maintenance of facilities will be conducted during the period from May 1 and December 1. Operations of this nature outside of this period will be evaluated upon written request to the Forest Service for such considerations. Approval or disapproval will be given in writing.

B. From the junction of Forest service Road ___ and ___ to the National Forest boundary dust abatement measures will be taken during all phases of well development or heavy maintenance.

C. The vehicle traffic gate located at the entrance to ___ on National Forest System Road ___will be kept closed and locked from ___ to ___. Motorized access beyond this gate is authorized to company personnel on company business for the operation of or emergency maintenance of the well.

D. A vehicle traffic gate and cattle guard will be constructed at the junction of the well access road and National Forest System Road ___. This gate will be kept closed and locked at all times. These facilities will be constructed to the standards listed in Appendix ___.

E. Cattle guards will be constructed to the specifications of the Authorized Officer. Cattle guard installations and any fence reconstruction will be constructed to the standards listed in Appendix ___.

F. The Forest Service representative will be designated by the District Ranger.

G. During clearing and construction operations, should subsurface cultural resource artifacts or materials be exposed, operations will be halted and the Forest Service notified.

H. The Forest Service recommends the operator conduct education programs to sensitize employees and contractors to the cultural and legal status of significant cultural resources.

I. During surveying, clearing and construction operations, the operator shall protect and preserve all land survey monuments. Records of found corners and monuments shall be given to the Forest Service.

J. The Forest Service recommends the operator consider prohibiting employees and contractors from bringing dogs onsite or carrying firearms.

K. The Forest Service recommends that the operator conduct periodic wildlife awareness programs covering seasonal wildlife requirements and sensitivities, how disturbance affects wildlife, and ways personnel can reduce disturbances.

II. WELL SIGN

A sign will be placed on the well pad with the following minimum information:
Company Name
Well Name and Number
Legal Location (1/4-1/4, Section, Township and Range)
County and State
Lease Number.

III. FIRE PREVENTION

A muffler or spark arrester satisfactory to the Forest Service will be maintained on the exhausts of all internal combustion engines used in conjunction with this operation

Refuse burning will not be allowed.

To the extent practical, the operator will take measures to prevent uncontrolled fires on the area of operation and to suppress uncontrolled fires resulting from operations. All fires will be reported to the Forest Service immediately.

IV. CLEARING

The cleared area will be kept to the minimum necessary for safe operation and has been reviewed on the ground by the Forest Service.

All trees to be removed will be designated by the Forest Service, measured and sold to the operator prior to being cut.

All slash created as a result of this project will be lopped and scattered to lie within one foot of the ground.

V. WELL PAD CONSTRUCTION

A. Excavation

Construction will be limited to soil conditions that will limit compaction and rutting.

Topsoil will be stripped and stored, for the use in the reclamation of the site. The Forest Service has approved a topsoil storage area. All cut bank areas will have the stored topsoil spread immediately after the well pad has been constructed. The remaining topsoil will be stored to accommodate its placement after drilling operations are completed.

Provisions will be made to divert surface water around and away from the well pad.

B. Pit Development

Sump pits will be located so that surface water flows will not enter them. Preferably, they will be located on high ground. Lacking such a location, provisions to divert surface flows will be made.

Sump pits and reserve pits will be excavated below ground level and the excavated material diked around the edges. The pits will not be filled to a depth greater than that reached at ground level, unless authorized in writing by the Forest Service.

Sump and reserve pits shall be made impermeable so they do not leak.

VI. ROAD CONSTRUCTION

The primary objective for road construction is to provide a safe, well drained, maintainable rock surfaced road for constant service and reasonable all-weather structural support for oil field truckloads accessing well pads on National Forest System lands. The "Gold Book" titled *OIL AND GAS Surface Operating Standards for Oil and Gas Exploration and Development* describes the minimum guidelines to be used to develop the road design necessary to meet the primary objective. All roads constructed/reconstructed on National Forest System lands will be designed or constructed under the direction of a registered professional engineer. A geo-technical engineer will be part of the design team to address those portions of the roads across steep slopes or which have characteristics for mass failure of the road and/or the side slopes.

The well access road will be considered a low volume, single lane road with turnouts built for the specific purpose of accessing, drilling, maintaining and operating a natural gas well.

The road standards are:

A. Design speed of 15 mph;
B. Travel width of 12 feet or that necessary for the critical vehicle with turnouts;
C. Minimum horizontal curve radius is 100 feet. Curve widening is necessary where terrain will not allow the 100-foot radius;
D. Road grade maximum of 8%, except for short pitches of 300 feet or less, unless previously approved by the Forest Service.
E. Turnout locations are generally naturally occurring, such as additional widths on ridges or other available areas on flat terrain;
F. Drainage shall be provided over the entire road. Usually this can be accomplished by the use of drainage dips. Ditches and culverts may be necessary to facilitate winter access.
G. A gravel surface will be applied for all weather access. An acceptable soil strength test, such as the C.B.R. Test, will be performed to determine gravel depths required for the maximum truck loads, under 100% saturated condition. A pavement design method will be used to determine required gravel depths. Six inch minus gravel, rolled in place to a nine-inch depth can be used as a base. Surfacing then will consist of one inch minus crushed gravel to provide a maintainable top surface minimum compacted depth of four inches. All gravel material will come from a source approved by the Forest Service. Some areas may require additional surfacing or some widening with surfacing. The sub-grade will be compacted to 95% AASHTO T-99 standards.
H. Traffic warning signs will be placed in accordance to MUTDC standards.
I. All disturbed areas, including cut and fill slopes, will be revegetated. The revegetation will utilize the same species as listed in the Appendix.

J. A flag line will be established over the entire route, as approved by the Forest Service at the time of the onsite visit. Flags will be placed approximately every 100 feet, or be intervisable, which ever is less.

On slopes of 0 to 20%, where horizontal and vertical alignment can be worked out on the ground, a Plan and Profile is not required. Standard templates, drainage locations and turnout locations will be provided. A Plan and Profile view will be the minimum drawing provided to the Forest Service for steeper slopes and at creek crossings. It will identify grade, alignment, stationing, clearing limits, turnout locations and culvert locations. Standard templates of road cross sections will be provided to the Forest Service.

VII. PIPELINE CONSTRUCTION

All pipelines and produced water pipelines used to connect this well with a collection system are required to be placed in the access new road right-of-way or immediately adjacent to it. It is recommended that the lines be placed in the in the same trench at the time of initial road construction prior to gravel surfacing.

The operator, its personnel, contractor or contractor's employees shall perform all work with explosives in such a manner as not to endanger life or property in accordance with all state and Federal regulations.

VIII. FENCE CONSTRUCTION

The entire well pad will be fenced and a gate or cattle guard provided where the well access road enters crosses the fence. The fence will be built within seven days after initial well drilling activities are completed. The fence will be maintained until the areas not needed for production are revegetated.

A standard barbed wire fence, wood post construction will be followed. Specific specifications are listed in the Appendix. The Forest Service will review any proposed modifications to the construction standards in advance.

IX. ACCESS ROADS

As a condition to the use of National Forest System Roads outside of the leasehold, the operator will obtain a Forest Service approved Road Use Permit. Applications are available from the Forest Service office in Bayfield.

X. OPERATIONS

The operator must notify the Columbine District Ranger or the authorized Forest Service representative 48 hours prior to commencing operations or resuming operations following their temporary cessation.

A. Drilling Operations

1. It is herein agreed that during all operations, the operator shall maintain his structures, equipment and other facilities in a safe, neat and workman like manner. Hazardous sites or conditions resulting

from the operations shall be marked by signs, fenced or otherwise identified to protect the public.

2. A Spill Contingency Plan will be provided to the Forest Service. A copy of this Plan shall be kept on file at the operator's project office and at the Columbine Ranger District Office.
3. In the event of a spill or leak, the Forest Service shall be immediately notified. Cleanup operations from the spill or leak shall be reviewed by the Forest Service and recommend additional action as necessary.
4. Certification or other approval issued by State Agencies with regulations relating to drilling operations above and beyond the requirements of these stipulations will be accepted.

B. Water Resources

No surface water will be removed, nor will water be disposed of on National Forest System lands without prior written approval from the Forest Service.

C. Road Maintenance

The operator shall maintain all Forest Service Roads used in conjunction with operations as herein outlined:

1. Remove slides, boulders, fallen timber, overhanging brush, and other material obstructing safe road sight distance and travel.
2. Replace fills and portions of fills lost and/or which have settled below the original grade and cross-section.
3. Keep drainage channels, ditches and culverts clear of debris and functioning as intended.
4. Repair fences, cattle guards, culverts, bridges and other structures to standard specifications.
5. Blade and shape surface and shoulders to maintain a suitable riding surface. Earth and debris from side ditches, slides, or other sources shall not be left on the road or mixed into the surface portions of the road. Blading must not undercut banks, nor shall gravel or other selected surface material be bladed off the surface width. Material from slides or other sources requiring removal from the road shall not be deposited in streams or stream channels or at locations where it will wash into streams and cause damage through silting or obstruction of the streams or reservoirs.
6. All maintenance shall be performed as needed. In addition, at the end of each operating season, maintenance work will be done to minimize damage from adverse weather. Such work shall include final blading to remove ruts and other irregularities that would prevent normal surface runoff, and final clearing of ditches and culverts to ensure satisfactory functioning of the road drainage system.

D. Snow Removal

To facilitate operations, the operator may remove snow from Forest Service Roads. Such removal shall be done in a manner to preserve and protect roads during

operations to the extent necessary to ensure safe and efficient transportation and prevent excessive erosion damage to roads, streams and other Forest values.

Snow removal work shall include:

1. Removal of snow from all of the travel way, including sufficient turnouts for safe and efficient use.
2. Leave culvert inlets in a natural condition without snow plowed into them so the drainage system will function naturally.
3. All debris, except snow and ice, removed from the road surface shall be deposited away from stream channels at Forest Service approved locations.
4. Banks shall not be undercut, nor shall gravel or other surfacing material be bladed off the road.
5. Ditches and culverts shall be kept functioning during operations and upon completion of operations.
6. "Snow Berm" is herein defined as a dike of snow resulting from operator's snow removal operations which extends above the surface of the travel way. The operator shall space, construct and maintain drainage holes in the snow berm to obtain surface drainage without discharge on erodible fills. In any event, the operator shall remove snow berms or construct drainage holes at the end of winter operations or before spring breakup, which ever is sooner.
7. Dozers may be used to plow snow with written approval of the Forest Service.
8. Equipment used to plow snow shall be equipped with shoes or runners to keep the blade a minimum two inches above the surface of the road, unless otherwise agreed to in writing by the Forest Service.
9. The Forest Service shall notify the operator in writing if surfacing material has been bladed off the surface of the road. The notice shall state the number of road miles (rounded up to the next 0.1 mile) and the cubic yard equivalent of surfacing bladed off. The Forest Service calculation of the cubic yardage will be available for review. Upon such notice, the operator shall replace the surfacing material, in kind, no later than 90 days after notification, unless otherwise agreed to in writing.

E. Sanitation and Garbage

1. A portable toilet will be made available. Sewage will be contained and disposed of at a designated sanitary disposal facility.
2. The well pad and adjoining areas will be kept in a neat and safe condition during all phases of the operation.
3. The operator shall take all reasonable precautions to prevent any dumping or spilling of oil or hazardous materials on National Forest System lands. The operator shall take the appropriate preventative measures to ensure that any spill of oil or hazardous material do not enter any stream or other waters. Any spillage of oil or hazardous material shall immediately be picked up and removed from National Forest System lands. Used oil resulting from servicing or repair of equipment shall not be disposed of on National Forest System lands, and shall be removed and disposed in a designated disposal site or recycling facility.

4. The well pad, adjoining area, and access road will be thoroughly cleaned of all trash and discarded equipment within five days of termination of operations. Cleanup operations also include removal of all flagging, wooden lath, signs and other identifying devices from National Forest Service System lands.
5. The operator shall dispose of refuse from this use, including waste materials, garbage and rubbish of all kinds by removing it from National Forest System lands.

XI. REHABILITATION

A. If the well is not productive, the entire well site and access road(s) shall be rehabilitated, unless otherwise directed by the Authorized Officer.

1. Well Pad and Access Road(s)
   a. Drill cuttings will be placed in a trench and buried upon completion of operations.
   b. Gravel surfacing, if used, will be removed from the well pad and access road(s) and disposed of off of National Forest System lands.
   c. The well site and associated access road(s) will be re-contoured to pre-construction conditions.
   d. Stored topsoil will be respread over the entire disturbed area.

2. Site Preparation

All areas of soil disturbance as a result of operations will be scarified to at least a 4-inch depth and drainage structures installed at Forest Service specified locations.

3. Revegetation

   a. After scarifying the disturbed areas, they will be revegetated with a seed mixture of pure live seed. The species seed mixture is listed in the Appendix. It is recommended that the seed mixture be applied with a drill.
   b. Seeding or planting will be done at a time of year that the Forest Service considers to offer the best chance of success. This effort will continue until such areas are revegetated and accepted.
   c. The operator is responsible for the treating and eliminating any noxious weeds that may be introduced and established on disturbed areas resulting from this activity. This responsibility remains until the disturbed areas are revegetated and accepted.
   d. Only Forest Service approved herbicides will be allowed. The operator will notify in writing the Forest Service when herbicides are proposed for use. The Forest Service will approve or disapprove the use in writing and the reasons for disapproval.

B. If the well is productive, those portions of the well pad not necessary for operations and maintenance shall be rehabilitated as specified previously and will include the following:

a. All permanent structures and equipment will be painted with one of the Standard Environmental Colors recommended by the Rocky Mountain Five State Interagency Committee and approved by the Forest Service.
b. Additional requirements may be necessary for surface resource protections and reclamation.

C. Monitoring – All facets of the surface operation will be monitored by the Forest Service to assure compliance to compliance to the Surface Use Plan of Operations. This will begin upon receiving notice that the operator will commence work and will continue throughout the active phases of well development on a regular visitation process and will continue on a periodic visitation until abandoned.

BLM SURFACE USE CONDITIONS OF APPROVAL

CONSTRUCTION AND DRILLING:

Note No. 1: Prior to beginning surface disturbing activities, fair market value for the timber value will be paid to the San Juan Field Office, Bureau of Land Management, 15 Burnett Court, Durango, Colorado 81301. Operator will survey and mark the outer boundaries of the right-of-ways and wells pads at **(well site name)**, then contact the BLM/USFS resource specialist for assessment of fair market value for the stumpage. BLM/USFS requires 2 weeks notification prior to road construction for assessment of fair market stumpage values.

Note No. 2: Prior to beginning surface disturbing activities, Operator will conduct baseline sampling of the nearest water well to the proposed BLM well site. Copies of this baseline sampling will be given to the water well owner and to the BLM. Follow-up testing upon well completion, and at 3 and 6 year intervals, is also required. If indications of induced contamination are observed, a series of steps will be taken to identify and mitigate contamination including: evaluation of Bradenhead tests, assessment of nearby gathering lines, and remedial actions where contamination sources are identified.

1. The operator or his contractor will contact the authorized officer at the San Juan Field office in Durango, Colorado (970) 247- 4874, 48 hours before beginning any work; and before beginning any reclamation.

2. If subsurface cultural resources are unearthed during operations, activity in the vicinity of the cultural resource will cease and a BLM representative notified immediately. Pursuant to 43 CFR 10.4 the holder of this authorization must notify the authorized officer, by telephone, with written confirmation, immediately upon the discovery of human remains, funerary items, sacred objects, or objects of cultural patrimony. Further, the operator must stop activities in the vicinity of the discovery and protect it for 30 days or until notified to proceed by the authorized officer.

3. The operator will fence off and mark with "no entry" signs the archaeological sites and isolated finds at the **(well site name)** well sites. Upon completion of the drilling and pipeline construction, fences and signs will be removed from the site. Installation of fencing will be performed under the supervision of a permitted archaeologist to ensure fences encompass the identified sites. All fences will be installed prior to beginning site work.

4. A permitted archaeologist will be present at **(well site name)** for monitoring purposes during the construction phase.

5. The operator is responsible for informing all persons associated with this project that they will be subject to prosecution for knowingly disturbing Native American Indian shrines, historic and prehistoric archaeology sites, or for collecting artifacts of any kind, including historic items and/or arrowheads and pottery fragments from Federal lands. Cultural resource monitoring is not required during construction.

6. The operator will assure that all vehicle traffic is limited to the bladed/traveled road surface. No pullouts or off-road parking will be allowed unless specifically authorized. "Keep vehicles on the road surface" signs may be installed by the operator to assist with compliance as needed. No

shortcutting by any motor vehicles operated by your employees or contractors, on roads not identified as access routes in your APD. Vehicular access to the pad will be strictly limited to authorized vehicles only; these vehicles are restricted to use on the drill- pad only: no off pad or off road parking.

7. The roads shall be wetted down and compacted where needed to avoid dust and loss of soil. If production is achieved, a minimum of 18 inch culverts will be placed in the permanent road as outlined in the oil and gas Gold book to reduce erosion. BLM may require additional culverts, if erosion or road damage is not well-controlled by initial construction.

8. All marked trees will be cut as close to the ground as possible and removed from public land. The limbs will be saved and stored for use in reclamation. All stumps will be crushed and splintered before adding to the stockpiled brush piles. All brush, limbs, crushed stumps and other woody material will be stockpiled separately from the topsoil just outside the wellpad perimeter. The stripped vegetation and 12 inches of topsoil shall be stockpiled separately just outside the wellpad perimeter. The stripped vegetation shall not be removed from the location (it will be used later for reclamation). If the topsoil stockpile is not used within six months it will be seeded to insure topsoil integrity and prevent erosion.

9. The reserve pit will be sealed in such a manner as to prevent leakage of the fluids. Methods available to insure containment of drilling fluids in the reserve pit include lining the inside of the pit with at least 10 mil plastic. If a plastic liner is used, the bottom of the pit shall be smooth and free of any sharp rocks. If the pit has a rocky bottom, it shall be bedded with a material such as soil, sand, straw or hay to avoid the possibility puncturing the liner. A minimum of not less than a 2 foot freeboard will be maintained in the pit at all times. All oil or floating debris will be removed from the pit immediately after the drilling phase or the well.

10. Prior to rigging up, a one foot high berm will be constructed around the perimeter of the wellpad in such a manner as to contain all storm events/spills from going downstream of the wellpad. A lined sump pit may be utilized to contain such fluids. The wellpad will be designed in such a manner as not to allow runoff water to enter the pad. The need for the berm will be reassessed upon the completion of the well and production is established.

11. The operator will immediately notify BLM resource specialists in the event a raptor nest is encountered near the work sites. BLM will determine if the nest is active, and if so, may require additional measures to avoid disturbance of a TES or BLM sensitive species.

12. Heavy equipment will be pressure washed at an offsite location prior to entering the site. This is a preventive measure for reducing noxious weed infestation at the drilling sites. If equipment is moved directly from site to site while on this project, then pressure washing between sites is not required. However, if equipment is removed from a site, used elsewhere, then brought back to the project area, pressure washing is required before the equipment can be used in the project area. This pertains to heavy equipment such as bulldozers, backhoes, etc. Pickup trucks and passenger vehicles do not require pressure washing prior to entering these sites.

13. Construction activities may be seasonally restricted to minimize the disturbance to wintering big game herds.

RECLAMATION:

1. If production is established, unused portions of the drillpad will be recontoured, topsoil spread, and reseeding per BLM requirements.

2. Immediately on completion of drilling, all trash and debris will be collected from the location and the surrounding area. All trash and debris will be disposed of in a mesh wire trash cage, and removed to an approved sanitary landfill.

3. Before any dirt work to restore the location takes place, the reserve pit must be completely dry. Any water remaining in the reserve pit should be disposed of in an approved disposal facility. All enhanced evaporation of the reserve pit fluids shall have prior approval of the authorized officer. The reserve pit must be reclaimed within 12 months (but no later than the following August 31) from the date the well is spudded. Before reclamation of the reserve pit proceeds, it will be dry and solid. This can be accomplished naturally or by artificial solidification. The reserve pit solids will not be squeezed out of pit. The liner shall be cut off at the mud level and removed to an approved disposal site. There will be a minimum of 2 feet of overburden on the pit prior to replacing the topsoil and seeding.

4. All disturbed areas will be recontoured to blend as nearly as possible with the natural topography. This includes removing all berms and refilling all cuts. All compacted portions of the pad will be ripped to a depth of 12 inches unless in solid rock.

5. The stockpiled topsoil will be spread evenly over the disturbed area. Seed will be broadcast between September 1 and December 1 with the following prescription. Seed may be drilled at half the rate of the broadcast seeding. Seed depth = 1/2 inch. All seeding rates in pounds of pure live seed. Seed should be adapted varieties. If the seed is broadcast, some means such as a harrow will be used to incorporate the seed into the soil. Certified weed free mulch may be required on locations with an inadequate supply of removed vegetation.

SEED MIXTURE

In the event grasses and native vegetation is not established after the first seeding application, subsequent applications will be required until grasses and/or native vegetation is established.

6. If directed by the Authorized Officer, water bars will be built as follows to control erosion:

Grade	Spacing
2%	Every 200 feet
2–4%	Every 100 feet
4–5%	Every 75 feet
5+%	Every 50 feet

7. Reclamation will be considered successful when the desired vegetative species are established, erosion is controlled, weeds are considered a minimal threat, and it is likely that ground cover will return to it a desirable condition. The operator will continue revegetation efforts until this standard is met.

PRODUCTION:

1. Noxious weeds which may be introduced due to soil disturbance or reclamation will be treated by methods to be approved by the Authorized Officer. These methods may include biological, mechanical, or chemical treatments. Should chemical or biological treatment be requested, the operator must submit a Pesticide Use Proposal to the Authorized Officer 60 days prior to the planned application date.
2. The roads shall be maintained reasonably smooth, and free of ruts, soft spots, chuckholes, rocks, slides and washboards. The BLM, San Juan Resource Area road specifications and "Gold" book shall be followed for specifications on road design and culvert installation. All weather surfacing will be required if well becomes a producer. A regular maintenance program shall include blading, ditching, sign replacement, surfacing, and culvert maintenance. The operator is required to correct maintenance deficiencies when documented and directed by the Authorized Officer. All vehicles servicing the well are restricted to use of the approved access road and well pad.
3. All production equipment shall be equipped with hospital type mufflers. Regardless of whether the operation is at the construction, drilling, or production phase, if the BLM determines that noise has become a nuisance, adequate muffling techniques will be applied.
4. Accidental spills will be cleaned up immediately, and contaminated soils will be removed to a State Permitted disposal site. BLM reporting procedures will be followed.
5. All permanent structures (onsite for six months or longer) constructed or installed will be painted a flat, nonreflective earthtone color which will be___.
6. The reserve pit and that portion of the location and access road not needed for production or production facilities will be reclaimed as described in the reclamation section. Enough topsoil will be kept to reclaim the remainder of the location at a future date. This remaining stockpile of topsoil will be seeded in place using the prescribed seed mixture.
7. Compaction and construction of the berms surrounding the tank or tank batteries will be designed to prevent lateral movement of fluids through the utilized materials, prior to storage of fluids. The berms must be constructed to contain at a minimum 120 percent of the storage capacity of the largest tank within the berm. All load lines and valves shall be placed inside the berm.
8. No gravel or other related minerals from new or existing pits on Federal land will be used in construction of roads, well sites, etc., without prior approval from the Surface Managing Agency.

SPECIAL CONDITIONS OF APPROVAL

1. Operator will test the produced water at each well site for inorganic common ions and metals after 3 months of continuous production. Thereafter, the produced water will be tested semi-annually for the next 24 months for common ions. Test results will be provided to BLM. These data are being collected as part of an ongoing study for beneficial uses of CBM produced water.

Appendix B
Lease Rights, Status and Stipulations

Appendix B — Lease Rights, Status and Stipulations

B.1 Lease Rights

An oil and gas lease grants the lessee the "right and privilege to drill for, mine, extract, remove and dispose of all oil and gas deposits" in the leased land, subject to the terms and conditions incorporated in the lease (Form 3110-2). Because the Secretaries of Interior and Agriculture have the responsibility to protect the environment within federal oil and gas leases on BLM and National Forest System (NFS) lands, restrictions are imposed on the lease terms .

The D.C. Circuit Court of Appeals in Sierra Club v. Peterson (717 F. 2d 1409, 1983) found that "on land leased without a No Surface Occupancy stipulation, the Department [of Agriculture] cannot deny the permit to drill; ... once land is leased, the Department no longer has the authority to preclude surface disturbing activity even if the environmental impact of such activity is significant. The Department can only impose mitigation measures upon a lessee who pursues surface disturbing exploration and/or drilling activities..."

In the absence of a No Surface Occupancy (NSO) or similar stipulation covering the entire lease, restrictions placed on oil and gas lease operations must be "reasonable." They cannot directly or indirectly prohibit, altogether, the development of the lease. Although an APD for a particular proposal can be denied if the proposed operations would have unacceptable impacts, the right to drill and develop somewhere on the leasehold cannot be denied by the Secretary unless a non-discretionary statute, such as the Endangered Species Act, prohibits the activity from occurring. In the absence of a ban to drilling imposed by such a statute, authority for complete denial can only be granted by Congress (Union Oil Company of California v. Morton, 512 F. 2d 743, 750-751; 9th Cir., 1975).

Industry's oil and gas leases contain various stipulations concerning surface disturbance, surface occupancy, and special stipulations regarding plan of construction and development, unstable soils, and wildlife habitat. In addition, the lease stipulations provide that the BLM may impose "such reasonable conditions, not inconsistent with the purpose for which the lease is issued, as the (BLM) may require to protect the surface of the leased land and the environment.

None of the stipulations, however, would empower the Secretary of Interior or Agriculture to deny all drilling activity because of environmental concerns. Certain lease provisions provide the Secretary authority to prohibit the lessee from occupying portions of the lease from direct drilling occupancy. If these provisions apply to the entire lease, and there is no acceptable means of mitigating significant adverse impacts to the stipulated resource values, then this would trigger denial of further lease development and require consideration and analysis of another alternative or alternatives. Or if the U.S. Fish and Wildlife

Service concludes that the APD would likely jeopardize the continued existence of any endangered or threatened plant or animal species, then an APD and/or lease development may be denied in whole or in part.

The Secretaries of the Interior and Agriculture have limited authority to deny all activity on a lease. However, to otherwise deny all activity could constitute a breach of an operator's right to conduct development activities on the lease land. For example, prior to the passage of the 1987 Leasing Reform Act, a California Court held in Union Oil Company of California v. Morton (512 F. 2d 743, 750-751; eighth Cir. 1975): "Congress itself can order the leases forfeited even now, subject to payment of compensation. But without Congressional authorization, the Secretary of the executive branch in general has no intrinsic powers of condemnation."

B.2 Lease Status

The Northern San Juan Basin Coal Bed Methane Environmental Impact Statement (EIS) Project Area involves numerous leases issued over a period of 30 years. The majority of NFS lands within the Project Area are leased. The leases contain all or combinations of the following stipulations:

Stipulations for Land under Jurisdiction of the U.S. Department of Agriculture (USDA) – Form 3109.3 (Requires compliance with USDA's rules and regulations on NFS lands). This stipulation is mandatory for all leases involving NFS lands.

Controlled Surface Use Stipulation (requires surface disturbing operations receive prior agency approval). This stipulation also requires an environmental analysis of impacts. Mitigation measures identified through the analysis will be attached to the application for permit to drill as conditions of approval.

Supplemental Stipulation to Form 3109-3. (Provides protection for existing roads, trails, streams, improvements, and cultural resources by establishing limited distances for site occupancy.)

Timing Limitation Stipulation. This stipulation requires that no activities other than routine well activities (activities that are conducted in the course of maintaining production operations at a well site such as daily site visits, minor repairs on surface equipment or removal of produced water by truck) shall take place from December 1 to April 30, unless approved by the Authorized Officer. Operations of this type outside of this period will be evaluated upon written request to the FS or BLM for such consideration. This stipulation reduces human/wildlife conflicts and loss of habitat effectiveness during the critical winter season.

Some of the lease agreements identified areas of NSO for unroaded lands of some of leases within the Project Area. The NSO was rescinded in 1981 in a decision notice for the Forest Service Roadless Area Review Evaluation II (RARE II). This decision was reaffirmed in the 1983 Record of Decision for the

Land and Resource Management Plan that identified the land as available for resource management activities, including roading.

Leases, identified as COC64932, COC63433, and COC64934 contain the following condition stipulation that will be acted on:

"Conditions requiring the use of special stipulations on these leases will be examined in the ongoing Northern San Juan Basin EIS. The NSO stipulations will remain in effect until such time as that analysis is completed. At that time, as expressly described in the Record of Decision for that analysis, the NSO decision will be waived, excepted, modified, or remain in full force and effect. The Northern San Juan Basin EIS will provide the basis for final determination of application of the NSO stipulations to these lease parcels."

Thus, the decision whether to waive, except, or modify the NSO stipulation for these lease parcels will be documented in the Record of Decision for this project and based upon the environmental consequences of such options in this EIS.

Two other leases in the Project Area, identified as COC64936 and COC64935, were issued in late 2001 with No Surface Occupancy Stipulations to comply with the January 12, 2001, Rule for Roadless Areas on National Forest Lands. The No Surface Occupancy stipulations for the two leases will either remain or be waived in the future depending on the outcome of litigation concerning the Roadless Rule and decision making for this project.

Figure 1–3 shows all federal leases in the Project Area, and also displays federal leases with NSO stipulations.

The majority of BLM administered lands in the Project Area are leased and are managed under a number of stipulations including, as appropriate:

[Stip. Code: CO-3] Raptors (includes golden eagle and osprey; all accipiters; falcons except Kestrel; butteos; and owls). Raptors that are listed and protected by the Endangered Species Act are addressed separately. NSO within one-eighth mile radius of nest site. Exception for raptor nest site. The NSO area may be altered depending on the active status of the nest site or the geographical relationship of topographic barriers and vegetation screening to the nest site.

[Stip. Code: CO-41] Bald Eagle NSO within one-quarter mile radius of the roost or nest site. Exception for bald eagle roost site. The NSO applies to the essential features of the winter roost site complex. The NSO area may be altered depending on the active status of the roost or the geographical relationship of topographic barriers and vegetation screening. There are no exceptions currently identified for nest sites.

[Stip. Code: CO-51] Peregrine Falcon NSO within one-quarter mile radius of cliff nesting complex. No specific exception criteria are currently identified.

[Stip. Code: CO-61] Mexican Spotted Owl NSO within one-quarter mile radius of the confirmed roost site and nesting site. No specific exception criteria are currently identified.

[Stip. Code: CO-81] NSO on habitat areas with special status plant species (Includes federally-listed and proposed species for listing and candidate species.) Exception for special status plant species habitat. The NSO may be altered after important factors are considered in a site-specific impact analysis such as the type and amount of surface disturbance, plant frequency and density, and the relocation of disturbances.

B.3 Timing Limitation Stipulations

[Stip. Code: CO-91] Big game species (includes species of mule deer, elk, pronghorn, antelope, and bighorn sheep). Note: Crucial winter habitat includes severe big game winter range or other definable winter ranges as mapped by the Colorado Division of Wildlife. Big Game Crucial Winter Habitat -December 1 to April 30. Exception for big game crucial winter habitat. Under mild winter conditions, the last 60 days of the seasonal limitation period may be suspended. Severity of the winter will be determined on the basis of snow depth, snow crusting, daily mean temperatures, and whether animals were concentrated on the crucial winter range during the winter months. Exception for big game crucial winter habitat. This limitation may or may not apply to work requiring a Sundry Notice pending environmental analysis of any operational or production aspects.

Big Game Birthing Areas: (by species)

a. Elk calving - April 16 to June 30

[Stip. Code: CO-161] Greater Sandhill Crane nesting and staging habitat areas – March 1 to October 16. No specific exception criteria are currently identified.

[Stip. Code: CO-171] White Pelican nesting and feeding habitat areas – March 16 to September 30. No specific exception criteria are currently identified.

[Stip. Code: CO-181] Raptor nesting and fledgling habitat (includes the golden eagle and all accipiters; falcons, except the kestrels[1]; all butteos; and owls except Mexican spotted owls - February 1 to August 15. Raptors that are listed and protected by the Endangered Species Act are addressed separately. This seasonal limitation applies to a one-quarter mile buffer zone around the nest site.

[Stip. Code: CO-191] Ferruginous hawk nesting and fledgling habitat – February 1 to August 15. The sensitivity of the ferruginous hawk to human associated disturbance activities requires a one-mile buffer zone to avoid nest abandonment.

[Stip. Code: CO-201] Osprey nesting and fledgling habitat – April 1 to August 31. The sensitivity of osprey to human associated disturbance activities requires a half-mile buffer zone to avoid nest abandonment. Exception for raptors, Ferruginous hawks, and Ospreys (#'s 6, 7, and 8, above) nesting habitat. During years when a nest site is unoccupied or unoccupied by or after May 15, the

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[1] Kestrels are very adaptable to nest in a variety of habitats and their populations are stable and widespread.

seasonal limitation may be suspended. It may also be suspended once the young have fledged and dispersed from the nest.

[Stip. Code: CO-211] Mexican Spotted Owl nesting and fledgling habitat – February 1 to July 31. The Mexican spotted owl has been petitioned for listing as a threatened or endangered species to U.S. Fish and Wildlife Service. Subject to the petition determination, the following habitat management guidelines and restrictions will be used to protect the Mexican spotted owl. These guidelines are adopted from the interim timber harvest management guidelines issued by the Forest Service, Southwest Region (Federal Register, Vol. 54, No.124, June 29, 1989). Mexican spotted owl habitat is restricted by use of a timing limitation applied to core areas within the owl habitat territory. The territories are by definition of two types: (1) territory in which an owl(s) has been spotted, but no nests or roosts have been confirmed, and (2) territory in which there is confirmed nesting, feeding, and roosting activity. The territory of a Mexican spotted owl is thought to be about 2,000 acres and does not overlap with another individual's (or pair's) territory. Within the territory is a core area of 450 acres where there have been sightings only ([l] above), or 1,480 acres where there are confirmed nests and/or roosts (121 above). The timing restriction from February 1 to July 31 is applied to the core areas (450 or 1,480 acres). A proposed oil and gas operation within the remainder of the territory (2,000 acres minus 450 or 1,480 acres) will be analyzed prior to permit approval and mitigated for compatibility with the owl habitat. No specific exception criteria are currently identified.

[Stip. Code: CO-221] Bald Eagle Nesting Habitat – December 15 to June 15. Restriction for bald eagle courtship behavior and nesting habitat. This time period is extremely sensitive to human-disturbance activities and may cause nest abandonment and desertion of long established territories. A one-half mile buffer zone around the nest site is required to prevent disruption of nesting. Exception for bald eagle nesting habitat. During years when a nest site is unoccupied by or after May 15, the timing limitation may be suspended. It may also be suspended once the young have fledged and dispersed from the nest.

[Stip. Code: CO-231] Winter Roost Site – November 16 to April 15. Restriction for bald eagle winter roost site. The sensitivity of bald eagles to human disturbance activities requires a one-half mile buffer area around the roost site to avoid relocation to less suitable areas. Exception for winter roost habitat. If there is partial or complete visual screening of the area of activity, the primary zone around the roost site may be reduced to one-quarter mile.

[Stip. Code: CO-241] Peregrine Falcon Cliff Nesting Complex – March 16 to July 31 Restriction for peregrine falcon cliff nesting complex. The sensitivity of peregrine falcon to human-disturbance activities requires a half-mile buffer area around the nesting complex to prevent abandonment and desertion of established territories. The following exception would apply only after formal Section 7 Consultation with the U.S. Fish and Wildlife Service was consummated. Exception for nesting habitat. During years when a nest site is unoccupied or unoccupied by or after May 15, the seasonal limitation may be suspended. It may also be suspended once the young have fledged and dispersed from the nest.

[Stip. Code: SJ-71] Bald Eagle Winter Concentration Areas: December 1 to April 15. No specific exception criteria are currently identified.

B.3.1 Controlled Surface Use Stipulations

[Stip. Code: CO-271] Prior to surface disturbance on Slopes of, or greater than, 40 percent, an engineering reclamation plan must be approved by the Authorized Officer. Such plans must demonstrate how the following will be accomplished:

a. Site productivity will be restored.

b. Surface runoff will be adequately controlled.

c. Off-site areas will be protected from accelerated erosion such as drilling, gullying, piping, and mass wasting.

d. Surface-disturbing activities will not be conducted during extended wet periods.

e. Construction will not be allowed when soils are frozen

No specific exception criteria are currently identified.

[Stip. Code: CO-281] For the protection of perennial water impoundments and streams, and/or riparian/wetland vegetation zones, activities associated with oil and gas exploration and development including roads, transmission lines, storage Facilities, are restricted to an area beyond the riparian vegetation zone. Exceptions: This stipulation may be excepted subject to an on-site impact analysis with consideration given to degree of slope, soils, importance to the amount and type of wildlife and fish use, water quality, and other related resource values. This stipulation will not be applied where the Authorized Officer determines that relocation up to 200 meters can be applied to protect the riparian system during well siting.

B.4 Lease Notices

[Stip. Code: CO-291] Prior to authorizing surface-disturbing activities in Class I and II Paleontological Areas, an inventory will be performed by an accredited paleontologist approved by the Authorized Officer.

B.5 Conditions of Approval

Mitigation Authority: The lease "granting clause" and Section 6 of Oil and Gas Lease Form. Post-lease operations proposals are reviewed to ensure conformance with the plan. The mitigative measures listed in Appendices D and F of the Colorado Oil and Gas Leasing and Development Plan Amendment and Final Environmental Impact Statement (January 1991) represent the post-lease environmental protection to which the BLM is committed. Note that there is no commitment to the specific wording of a listed Condition of Approval (COA), but rather to the level of impact protection implied in the COA.

The mitigative measures listed in Appendices D and F of the Colorado Oil and Gas Leasing and Development Plan Amendment and Final Environmental Impact Statement (January 1991) apply to all BLM oil and gas exploration and development activities and associated rights-of-way as applicable. The Authorized Officer will choose among these measures at the field development stage to mitigate or avoid environmental impacts identified on a site-specific basis. When attached to an approval document, the measures are known as COAs. The Authorized Officer is not limited to the list of COAs shown in the referenced appendices, but may develop others as the potential for local impacts is identified at the time of a site-specific proposal so long as the new COAs conform with the limitations of the granted lease rights and the guidance set forth in the applicable planning documents and subsequent amendments.

COAs are not added to applications if they are unnecessary (do not apply to the case in question) or, are duplicative, as when the mitigative measure is already incorporated in the operator's submittal.

Appendix C

Notices of Intent to Prepare an Environmental Impact Statement

broaden the definition of a coastal barrier, and approved a series of maps entitled "Coastal Barrier Resources System" dated October 24, 1990. These maps identify and depict those coastal barriers located on the coasts of the Atlantic Ocean, Gulf of Mexico, and the Great Lakes and in Puerto Rico and the Virgin Islands that are subject to the Federal funding limitations outlined in the Act. The 1990 Act also approved a related series of maps depicting otherwise protected areas (OPA) along the same coastlines. In full System units most forms of Federal subsidies are prohibited. In OPAs only Federal flood insurance is prohibited.

The Act also defines our responsibilities regarding the System and OPA maps. We have official custody of these maps and prepare and distribute copies of them. We published a notice of the filing, distribution, and availability of the maps dated October 24, 1990, in the **Federal Register** on June 6, 1991 (56 FR 26304–26312). We have announced all subsequent map revisions in the **Federal Register**.

Revisions to a System Unit and OPA in North Carolina

Section 1(a) of Public Law 106–16, enacted on November 29, 1999, requires us to replace 7 maps relating to the System with 14 new maps. These changes affect a Coastal Barrier Resources System Unit (designated as L03) and an OPA (designated as NC–03P) in Dare County, North Carolina. The changes to the Cape Hatteras NC–03P are designed to coincide with the boundary of the Cape Hatteras National Seashore. The changes to Hatteras Island Unit L03 are designed to meet the original intent of Congress.

How To Get Copies of the Maps

The Service has given copies of the revised System and OPA maps to the House of Representatives Committee on Resources and the Senate Committee on Environment and Public Works, and will be sending copies to the House of Representatives Committee on Banking and Financial Services and each appropriate Federal, State, and local agency having jurisdiction over the areas in which the modified units are located.

You can purchase copies of System and OPA maps from the U.S. Geological Survey, Earth Science Information Center, P.O. Box 25286, Denver, Colorado 80225. The cost is $4.00 per map, plus a $3.50 shipping and handling fee for the entire order. Maps can also be viewed at the following Fish and Wildlife Service offices:

Washington Office—all System and OPA maps.

U.S. Fish and Wildlife Service, Division of Habitat Conservation, 4401 N. Fairfax Drive, Room 400, Arlington, Virginia 22203, (703) 358–2201

Southeast Regional Office—all System and OPA maps for Alabama, Florida, Georgia, Louisiana, Mississippi, North Carolina, and South Carolina.

Region 4, U.S. Fish and Wildlife Service, 1875 Century Blvd., Atlanta, Georgia 30345, (404) 679–7125

Field Office—System and OPA maps for North Carolina.

Field Supervisor, U.S. Fish and Wildlife Service, Raleigh Field Office 551–F Pylon Drive, P.O. Box 33726, Raleigh, NC 27636–3726, (919) 856–4520

Dated: March 23, 2000.

Jamie Rappaport Clark,

Director, Fish and Wildlife Service.

[FR Doc. 00–8189 Filed 4–3–00; 8:45 am]

BILLING CODE 4310–55–P

DEPARTMENT OF THE INTERIOR

Fish and Wildlife Service

Endangered and Threatened Species Permit Application

AGENCY: Fish and Wildlife Service, Interior.

ACTION: Notice of receipt of application.

The following applicant has applied for a permit to conduct certain activities with endangered species. This notice is provided pursuant to section 10(c) of the Endangered Species Act of 1973, as amended (16 U.S.C. 1531, *et seq.*).

Permit Number TE 024653

Applicant: Mark Hove, Macalester College, St. Paul, Minnesota.

The applicant requests a permit to take (collect) the following endangered species from the St. Croix River, from river miles 0–150 in Minnesota and Wisconsin: Winged mapleleaf (*Quadrula fragosa*) and Higgins' eye pearlymussel (*Lampsilis higginsi*). Activities are proposed for the enhancement of survival of the species in the wild.

Written data or comments should be submitted to the Regional Director, U.S. Fish and Wildlife Service, Ecological Services Operations, 1 Federal Drive, Fort Snelling, Minnesota 55111–4056, and must be received within 30 days of the date of this publication.

Documents and other information submitted with this application are available for review by any party who submits a written request for a copy of such documents to the following office within 30 days of the date of publication of this notice: U.S. Fish and Wildlife Service, Ecological Services Operations, 1 Federal Drive, Fort Snelling, Minnesota 55111–4056. Telephone: (612/713–5343); FAX: (612/713–5292).

Dated: March 29, 2000.

T.J. Miller,

Acting Assistant Regional Director, Ecological Services, Region 3, Fort Snelling, Minnesota.

[FR Doc. 00–8255 Filed 4–3–00; 8:45 am]

BILLING CODE 4310–55–P

DEPARTMENT OF THE INTERIOR

Bureau of Land Management

DEPARTMENT OF AGRICULTURE

Forest Service

[CO–170000]

Notice of Intent to Prepare an Environmental Impact Statement (EIS) and Public Scoping; San Juan Basin, Colorado

AGENCY: Bureau of Land Management, USDI, and U.S. Forest Service, USDA.

ACTION: Notice of Intent to Prepare an Environmental Impact Statement (EIS) and conduct public scoping; San Juan Basin, Colorado. Also, the action proposes to amend both the BLM's San Juan and San Miguel Resource Management Plan (RMP) of 1985, and the Colorado Oil and Gas Leasing and Development Final EIS of 1991.

SUMMARY: In accordance with the National Environmental Policy Act, notice is hereby given that the Bureau of Land Management (BLM) and the U.S. Forest Service (USFS), as joint lead agencies, are initiating the preparation of an Environmental Impact Statement (EIS) with associated public scoping, on the proposed continued development of Fruitland Coalbed Methane (CBM) gas. The EIS analysis area (106,000 acres) generally encompasses land north of the Southern Ute Line and within the San Juan Basin, and is bordered on the north, west, and east by the Fruitland Outcrop. The east side of the analysis area dips south at the San Juan National Forest boundary and includes all San Juan National Forest lands within the Basin, south of the Southern Ute line. This EIS will be undertaken in cooperation with La Plata County, Colorado. The proposed action, within the analysis area, is for the development

of additional Fruitland CBM wells and associated facilities on multi-jurisdictional lands (BLM, USFS, and non-federal) within the San Juan Basin of southwestern Colorado. The EIS will address environmental impacts and mitigation measures associated with drilling, production and eventual abandonment of these additional Fruitland CBM wells. The EIS will also disclose direct, indirect, and cumulative impacts of projected CBM development on non-federal land within the described area.

DATES: Written comments will be accepted until June 1, 2000. Two public scoping meetings will be held, one beginning at 4:00 p.m. on May 16, 2000 at the BLM/USFS Public Lands Center, Durango, Colorado and the other beginning at 5:00 p.m. on May 17, 2000 at the Bayfield High School, in Bayfield, Colorado.

ADDRESSES: Comments should be sent to the Bureau of Land Management, San Juan Field Office Manager, 15 Burnett Court, Durango, Colorado 81301.

FOR FURTHER INFORMATION CONTACT: Ilyse Auringer, Jim Powers, or Paul Peck (970) 247–4874.

SUPPLEMENTARY INFORMATION: The objectives of the EIS will be to study and assess the impacts of additional Fruitland CBM drilling and development within the described area of southwestern Colorado. Potential impacts of the proposed action involve various natural and human resources including, geology, water resources, biological (*e.g.*, threatened and endangered species) wildlife, cultural, visual, land use, suburban interface and subdivisions, socioeconomic and others that are identified through the scoping process.

The proposed action will involve federal jurisdictions of the BLM and Forest Service. Two Record of Decisions, one by the BLM and one by the Forest Service will be issued. Much of the BLM jurisdiction is split estate land (where the mineral owner is not the same as the surface owner). Because of the large proportion of private mineral and surface estate contained in the proposed action, La Plata County will participate on this EIS as a Cooperating Agency. The Colorado Oil and Gas Conservation Commission will be an active, though informal, contributor. A memorandum of agreement is anticipated between the BLM, USFS, and La Plata County.

The BLM and Forest Service will issue interim criteria for those proposed Applications for Permit to Drill (APDs) received prior to the completion of the EIS and the two Record of Decisions (ROD's). The interim criteria will define those actions that would not limit the choice of reasonable alternatives and thus may be approved; as well as define those actions that may preclude future options and therefore may not be approved during preparation of the EIS and ROD's. The interim criteria will be subject to their own 30-day public comment period.

It is anticipated that the EIS process will take 24 months to complete and will include public information and meetings. Publication of the two ROD's is anticipated in March 2002. Public information, scoping meetings, and request for input on the EIS will begin with publication of this notice. Written comments must be submitted on or before June 1, 2000.

Dated: March 27, 2000.

Calvin N. Joyner,

San Juan Field Office Manager, BLM, Colorado, and Forest Supervisor, San Juan National Forest, USFS, Colorado.

[FR Doc. 00–8266 Filed 4–3–00; 8:45 am]

BILLING CODE 4310–JB–P

DEPARTMENT OF THE INTERIOR

Bureau of Land Management

[CO–700–00–0777–XQ–1784]

Southwest Resource Advisory Council Meeting

AGENCY: Bureau of Land Management, Interior.

ACTION: Notice; Southwest Resource Advisory Council Meeting.

SUMMARY: Notice is hereby given that the Southwest Resource Advisory Council (Southwest RAC) will meet in May, 2000 in Gunnison, Colorado.

DATES: The meeting will be held on Thursday, May 11, 2000.

ADDRESSES: For additional information, contact Roger Alexander, Bureau of Land Management, Southwest Center, 2465 South Townsend Avenue, Montrose, Colorado 81401; phone 970–240–5335; TDD 970–240–5366; e-mail Roger__Alexander@co.blm.gov.

SUPPLEMENTARY INFORMATION: The May 11, 2000 meeting will be held at the Gunnison County Fairgrounds Multipurpose Building, 275 South Spruce Street in Gunnison, Colorado. The meeting will begin at 9:00 a.m. and at approximately 4:30 p.m. The morning agenda will focus on the implementation of BLM Colorado Standards for public land health and Guidelines for livestock grazing and the Gunnison Sage Grouse Conservation Plan. General public comment is scheduled for 9:15 a.m. A field trip to nearby grazing allotments is scheduled during the afternoon session. The public is invited to accompany the RAC on the field trip but will need to provide their own transportation; a four wheel drive vehicle is recommended.

Summary minutes for Council meetings are maintained in the Southwest Center Office and on the World Wide Web athttp://www.co.blm.gov/mdo/mdo__sw__rac.htm and are available for public inspection and reproduction within thirty (30) days following each meeting.

Dated: March 23, 2000.

Roger Alexander,

Public Affairs Specialist.

[FR Doc. 00–8192 Filed 4–3–00; 8:45 am]

BILLING CODE 4310–JB–P

DEPARTMENT OF THE INTERIOR

Bureau of Land Management

Notice of Meeting

AGENCY: Lower Snake River District, Bureau of Land Management, Interior.

ACTION: Meeting Notice.

SUMMARY: The Lower Snake River District Resource Advisory Council will meet in Boise. Potential agenda topics are the Interior Columbia Basin Ecosystem Management Plan, the Integrated Natural Resources Management Plan for the U.S. Air Force Enhanced Training in Idaho project, sage grouse habitat management, implementation of rangeland standards and guidelines, proposed land exchanges and other land management issues.

DATES: May 3, 2000. The meeting will begin at 9 a.m. Public comment periods will be held at 9:30 a.m. and 4:00 p.m.

ADDRESSES: The meeting will be held at the Lower Snake River District Office, located at 3948 Development Avenue, Boise, Idaho.

FOR FURTHER INFORMATION CONTACT: Barry Rose, Lower Snake River District Office (208–384–3393).

Dated: March 29, 2000.

Katherine Kitchell,

District Manager.

[FR Doc. 00–8209 Filed 4–3–00; 8:45 am]

BILLING CODE 4310–84–U

Prineville Oregon 97754, telephone (541) 416–6784.

SUPPLEMENTARY INFORMATION: Violation of this closure order is punishable by a fine not to exceed $1,000 and/or imprisonment not to exceed 12 months as provided in 43 CFR 9268.3(d)(iv).

Dated: June 1, 2000.

Don L. Smith,

Acting District Manager, Prineville District Office.

[FR Doc. 00–14641 Filed 6–8–00; 8:45 am]

BILLING CODE 4310–33–M

DEPARTMENT OF THE INTERIOR

Bureau of Land Management

[NM–932–4120–05; OKNM 104590]

Invitation To Participate; Exploration for Coal in Oklahoma

AGENCY: Bureau of Land Management, Interior

ACTION: Notice.

SUMMARY: Members of the public are hereby invited to participate with Farrell Cooper Mining Company on a pro rata cost sharing basis, in a program for the exploration of coal deposits owned by the United States of America. The lands are located in Haskell County, Oklahoma, and are described as follows:

T. 10 N., R. 21 E., Indian Meridian
Sec. 1, S½, NE¼;
Sec. 12, NW¼, N½SW¼, SW¼SW¼, NW¼SE¼, W½NE, and NE¼NE¼;
Containing 920.00 acres, more or less.

Any parties electing to participate in this exploration program shall notify in writing, both the Sate Director, Bureau, of Land Management, NW Mexico State Office, P.O. Box 27115, Santa Fe, New Mexico 87502–0115, and Farrell Cooper Mining Company, P.O. Box 11050, Fort Smith, Arkansas 72917. such written notice must include a justification for wanting to participate and any recommended changes in the exploration plan with specific reasons for such changes. The notice must be received no later than 30-calendar days after the publication of this notice in the Federal Register.

This proposed exploration program is for the purpose of determing the quality and quantity of the coal in the area and will be conducted pursuant to an exploration plan to be approved by the Bureau of Land Management. A copy of the exploration plan as submitted by Farrel Cooper Mining company may be examined at the Bureau of land Management, New Mexico State Office, 1474 Rodeo Road, Santa Fe, New Mexico 87502, and the Tulsa Field Office, 7906 East 33rd Street, Suite 101, Tulsa, Oklahoma 74145.

Dated: June 1, 2000.

Carsten F. Goff,

Acting State Director.

[FR Doc. 00–14642 Filed 6–8–00; 8:45 am]

BILLING CODE 4310–84–M

DEPARTMENT OF THE INTERIOR

Bureau of Land Management

DEPARTMENT OF AGRICULTURE

Forest Service

Environmental Impact Statement for Fruitland Coalbed Methane Gas Development

AGENCY: Bureau of Land Management, USDI, and Forest Service, USDA.

ACTION: Notice of meetings.

SUMMARY: The Forest Service San Juan National Forest and the Bureau of Land Management San Juan Field Office published a notice of intent to prepare an environmental impact statement for the Fruitland Coalbed Methane Gas Development on April 4, 2000, (65 FR 17672). Included in the notice were dates for public meetings to review the notice of intent. This notice changes the public meeting dates from May 16 to June 28, 2000, and from May 17 to June 29, 2000, and extends the comment period for written comments for the notice of intent from June 1 to July 14, 2000. These changes are necessary to accommodate increased public interest.

DATES: The meetings will be held on June 28, 2000, and June 29, 2000; written comments must be received by July 14, 2000.

ADDRESSES: The June 28 meeting will be held at La Plata County Fairgrounds, Exhibit Hall, 2500 Main Street, Durango, Colorado; the June 29 meeting will be held at Bayfield High School, 800 County Road 501, Bayfield, Colorado. Both meetings will be from 5 p.m. to 8 p.m. Written comments should be sent to the San Juan Field Office Manager, Bureau of Land Management, USDI, 15 Burnett Court, Durango, Colorado 81301.

FOR FURTHER INFORMATION CONTACT: Jim Powers (970) 247–4874.

Dated: June 1, 2000.

Calvin N. Joyner,

San Juan Field Office Manager, Colorado, Bureau of Land Management, USDI, and Forest Supervisor, San Juan National Forest, Colorado, Forest Service, USDA.

[FR Doc. 00–14639 Filed 6–8–00; 8:45 am]

BILLING CODE 4310–JB–P

DEPARTMENT OF THE INTERIOR

Bureau of Land Management.

[NV–056–1430-ES; N–41567–29]

Notice of Realty Action: Lease/ conveyance for Recreation and Public Purposes

AGENCY: Bureau of Land Management, Interior.

ACTION: Recreation and public purpose lease/conveyance.

SUMMARY: The following described public lands in Las Vegas, Clark County, Nevada, were segregated on December 1, 1996 for administrative purposes under serial number N–61855. This segregation on the lands listed below will be terminated upon publication of this notice in the **Federal Register**. The land has been examined and found suitable for lease/conveyance for recreational or public purposes under the provisions of the Recreation and Public Purposes Act, as amended (43 U.S.C. 869 *et seq.*). The Clark County School District proposes to amend their current Recreation and Public Purposes lease N–41567–29 to include the following lands for development and expansion of Edith Garehime Elementary School.

Mount Diablo Meridian, Nevada

T. 20 S., R. 60 E.,
Section 8: S½NW¼NE¼NW¼, Containing 5 acres, more or less.

The land is not required for any federal purpose. The leases/ conveyances are consistent with current Bureau planning for this area and would be in the public interest. The leases/ patents, when issued, will be subject to the provisions of the Recreation and Public Purposes Act and applicable regulations of the Secretary of the Interior, and each will contain the following reservations to the United States:

1. A right-of-way thereon for ditches or canals constructed by the authority of the United States, Act of August 30, 1890 (43 U.S.C. 945).

2. All minerals shall be reserved to the United States, together with the right to prospect for, mine and remove such deposits from the same under applicable law and such regulations as the Secretary of the Interior may prescribe.

And will be subject to:

1. Easements in favor of City of Las Vegas for roads, public utilities and flood control purposes.

2. All valid and existing rights, which are identified and shown in the case file.

Prineville Oregon 97754, telephone (541) 416–6784.

SUPPLEMENTARY INFORMATION: Violation of this closure order is punishable by a fine not to exceed $1,000 and/or imprisonment not to exceed 12 months as provided in 43 CFR 9268.3(d)(iv).

Dated: June 1, 2000.

Don L. Smith,

Acting District Manager, Prineville District Office.

[FR Doc. 00–14641 Filed 6–8–00; 8:45 am]

BILLING CODE 4310–33–M

DEPARTMENT OF THE INTERIOR

Bureau of Land Management

[NM–932–4120–05; OKNM 104590]

Invitation To Participate; Exploration for Coal in Oklahoma

AGENCY: Bureau of Land Management, Interior

ACTION: Notice.

SUMMARY: Members of the public are hereby invited to participate with Farrell Cooper Mining Company on a pro rata cost sharing basis, in a program for the exploration of coal deposits owned by the United States of America. The lands are located in Haskell County, Oklahoma, and are described as follows:

T. 10 N., R. 21 E., Indian Meridian
Sec. 1, S½, NE¼;
Sec. 12, NW¼, N½SW¼, SW¼SW¼, NW¼SE¼, W½NE, and NE¼NE¼;
Containing 920.00 acres, more or less.

Any parties electing to participate in this exploration program shall notify in writing, both the Sate Director, Bureau, of Land Management, NW Mexico State Office, P.O. Box 27115, Santa Fe, New Mexico 87502–0115, and Farrell Cooper Mining Company, P.O. Box 11050, Fort Smith, Arkansas 72917. such written notice must include a justification for wanting to participate and any recommended changes in the exploration plan with specific reasons for such changes. The notice must be received no later than 30-calendar days after the publication of this notice in the Federal Register.

This proposed exploration program is for the purpose of determing the quality and quantity of the coal in the area and will be conducted pursuant to an exploration plan to be approved by the Bureau of Land Management. A copy of the exploration plan as submitted by Farrel Cooper Mining company may be examined at the Bureau of land Management, New Mexico State Office, 1474 Rodeo Road, Santa Fe, New Mexico 87502, and the Tulsa Field Office, 7906 East 33rd Street, Suite 101, Tulsa, Oklahoma 74145.

Dated: June 1, 2000.

Carsten F. Goff,

Acting State Director.

[FR Doc. 00–14642 Filed 6–8–00; 8:45 am]

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DEPARTMENT OF THE INTERIOR

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FOR FURTHER INFORMATION CONTACT: Jim Powers (970) 247–4874.

Dated: June 1, 2000.

Calvin N. Joyner,

San Juan Field Office Manager, Colorado, Bureau of Land Management, USDI, and Forest Supervisor, San Juan National Forest, Colorado, Forest Service, USDA.

[FR Doc. 00–14639 Filed 6–8–00; 8:45 am]

BILLING CODE 4310–JB–P

DEPARTMENT OF THE INTERIOR

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[NV–056–1430-ES; N–41567–29]

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1. A right-of-way thereon for ditches or canals constructed by the authority of the United States, Act of August 30, 1890 (43 U.S.C. 945).

2. All minerals shall be reserved to the United States, together with the right to prospect for, mine and remove such deposits from the same under applicable law and such regulations as the Secretary of the Interior may prescribe.

And will be subject to:

1. Easements in favor of City of Las Vegas for roads, public utilities and flood control purposes.

2. All valid and existing rights, which are identified and shown in the case file.

Appendix D

Evaluation of Coalbed Methane Well Types in the San Juan Basin

Evaluation of Coalbed Methane Well Types in the San Juan Basin

Prepared for

The Bureau of Land Management

March 2004

Prepared by

Malkewicz Hueni Associates, Inc.

Evaluation of Coalbed Methane Well Types In the San Juan Basin

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Evaluation of Coalbed Methane Well Types In the San Juan Basin

1.0 BACKGROUND

Malkewicz Hueni Associates, Inc. (MHA) received a Task Order from the U. S. Bureau of Land Management (BLM) to evaluate the production behavior of different types of coalbed methane wells in the San Juan Basin, including horizontal wells. This report provides the results of the study and is composed of three main subject areas:

1. Literature review of the application of horizontal wells in coal seams.
2. Comparison of gas recovery performance using vertical, horizontal and directional gas wells in the San Juan Basin.
3. Capturing the current industry position on horizontal and directional drilling in San Juan Basin.

MHA has made every effort to maintain an unbiased approach in this investigation while remaining fully aware that the results of the study may not totally agree with those of other interested parties such as active oil and gas operators in San Juan Basin, environmental groups, concerned citizens and governmental agencies. This study was conducted by researching technical and trade publications of the oil and gas industry and by interviewing several San Juan Basin producing companies. Therefore, conclusions offered herein are derived from the findings of industry technical experts and from operators who participated in providing their company's perspective on the topic.

2.0 SUMMARY

Despite the success of horizontal and directional drilling in conventional oil and gas reservoirs over the past couple of decades, application of such drilling techniques in coal bed methane (CBM) reservoirs has so far produced mixed results. The drilling technology itself has enjoyed significant progress in recent years and it appears that the technical expertise of the leading drilling companies to directionally or horizontally drill wells today in the San Juan Basin is currently at a high level. Furthermore, research and modeling work aimed at understanding the production characteristics of deviated wellbores in coal seams and coal mines over the past two decades have laid a sound foundation for continued improvement of this technology.

Despite these developments, however, significant technical challenges remain to be addressed before deviated and horizontal wells are adopted overwhelmingly by the industry. These include, but are not limited to, wellbore mechanical stability, effective stimulation, improved completion techniques, artificial lift, drilling cost, reservoir-wellbore connectivity issues and long-term productivity.

As the angle of deviation exceeds a critical threshold of about 30-35 degrees, these technical challenges become even more important, reaching their highest level for the case of horizontal wellbores. Further research and development is needed to address these issues before the industry feels comfortable with the risk/reward aspect of horizontal drilling in CBM and its ability to predict both short- and long-term performance. At the present time, the general consensus of the oil and gas operators in the San Juan Basin is that the horizontal and/or directional drilling offers the potential to add reserves and decrease drilling density. However, performance of the horizontal and deviated wells to-date has not precipitated widespread acceptance of this technology in the San Juan Basin. As a consequence, smaller operators appear to face difficulties in securing financing from bankers to apply these drilling techniques as this technology is perceived to be unreliable in providing higher rates and reserves. Similarly, pipeline companies are reluctant to commit resources on the development of surface infrastructure at the present time without a guarantee of sustainable, long term production growth from the producing companies.

A review of the performance of both the recent and older sets of horizontal and highly deviated wells in the San Juan Basin indicates that both types of wells have, on average, higher initial rates but in the longer term perform poorer than expected because of mechanical problems such as plugging with coal fines, wellbore stability, and loading of fluids in the deviated sections. Recent performance data for newer wells, however, appears to indicate that that industry is beginning to make significant progress in addressing some of these technical challenges. Horizontal and highly deviated CBM wells in the San Juan Basin cost between two (2) and four (4) times more than a vertical well, but do not usually provide a commensurate increase in rate and reserves; hence they may not be economically attractive at the present time. There have been encouraging rates exhibited in recently drilled wells and, if continued, will certainly work in favor of horizontal and deviated drilling. Based on a review of industry production data, horizontal wells have exhibited an average improvement in rate and recovery of between 1.1 and 1.6 times that of an average vertical well offsetting the horizontal well. The average highly deviated well has not demonstrated this improvement, exhibiting an average rate and reserve improvement of between 0.8 and 0.9 times that of an average vertical well offsetting the deviated well.

Another challenge facing the operators is finding areas where reservoir rock properties and geologic settings are favorable for horizontal drilling. For instance, in the fairway region of San Juan Basin (New Mexico) where the coals are more permeable and have higher fracture density, the stress environment is such that horizontal wells have a higher probability of experiencing mechanical failure than in the tighter regions further north in Colorado. However, these northern regions have historically been producing at a much lower rate than the Fairway wells, which brings into focus the issue of risk and potential reward in horizontal drilling. In addition, horizontal wells can be drilled more economically if the majority of the gas is stored in a single, thick coal seam with significant lateral continuity. The eastern portion of the Northern San Juan Basin EIS study has lower permeability, but relatively thick coal in two distinct coal intervals. The western portion of the area, however, has very different geological characteristics from

the eastern area and is characterized by multiple distinct coal seams. The impact of reservoir geology on the long term performance of horizontal wells in San Juan coal has not yet been fully evaluated. It is anticipated that with a modest surge in horizontal and directional drilling in the last couple of years, significant learning and technological development will be achieved over the next 2-5 years.

3.0 INTRODUCTION

The exploitation of CBM requires a full understanding and knowledge of coal reservoir geologic characteristics, gas desorption mechanism and fluid flow behavior in coal beds, drilling and completion practices, surface facilities and a myriad of environmental issues. In general, industry operational practices endeavor to maximize production, reduce costs, enhance operational safety, and mitigate the environmental damage inherent in such operations. New technologies have been developed to help companies achieve these objectives and they represent improvements over the older technologies.

There are generally four types of wellbores used in the San Juan Basin for CBM production: (a) vertical, (b) directional, (c) horizontal, and (d) multilateral. These have also been referred to as deviated wells, slant-hole wells and s-turn wells by the oil and gas literature and they are all considered some form of directional drilling.

Horizontal wells are defined as wells deviated more than 75 degrees from vertical (Lacy et al. 1991). Their primary purpose is to track the oil- or gas-bearing rock in order to maximize production rate and recovery. The three primary types of horizontal wells are Short-Radius, Medium-Radius and Long-Radius wellbores.

Multilateral wells entail drilling two or more horizontal legs from a single vertical well in order to maximize exposure to the oil- or gas-bearing strata. Multilateral drilling represents the newest of such techniques with the least industry experience. Vertical wells constitute by far the majority of wells drilled in San Juan Basin. Years of experience, reliability, and lower drilling and maintenance costs characterize the primary advantages of vertical wells. Vertical wells, however, have to be drilled with closer well spacing to improve sweep efficiency and maximize production. This puts the vertical wells at a disadvantage relative to directional or horizontal wells as it leads to increased environmental impact resulting from surface disturbance associated with drilling activity. Alternatively, multilateral drilling minimizes surface disturbances to the maximum degree and, hence, is ideal for environmentally sensitive areas in the Basin. These types of wells, however, are significantly more expensive to drill, are in a higher risk category from an investment point of view, and have not yet established a proven track record for their technical superiority over the conventional vertical wells. Directional wells with a deviation angle less than 30 degrees are being drilled with more frequency in the San Juan Basin because stimulation and completion techniques developed extensively for vertical wells can be applied to these wells with only slight modifications. Furthermore, this type of technology is often ideal when there are certain limitations for drill pad placement such as topographical features and/or surface cultural layout.

4.0 CONCLUSIONS

1. San Juan Basin horizontal and deviated CBM wells on average have higher initial rates but their longer term performance has been poorer than expected because of mechanical problems related to plugging with coal fines, wellbore stability, and loading of fluids in the deviated section. While very recent drilling, particularly by CDX Gas suggests that some of these problems are being overcome, additional time is needed to verify longer term stability and improved rate performance for these wells.

2. MHA reviewed the San Juan Basin CBM performance of 17 horizontal wells, 13 highly deviated wells, and 71 vertical wells that immediately offset the horizontal and highly deviated wells. Two comparison methods were used. The first method determined a 'performance index' derived by comparing both the EUR and the maximum annual producing rate of the horizontal or deviated well with the same values for the offsetting vertical well(s). The performance index was calculated by taking half the quotient of the horizontal well EUR divided by the average offsetting vertical well EUR and adding half the quotient of the horizontal well maximum annual rate divided by the maximum annual rate of the average offsetting vertical well. A value of one would imply that there was essentially no difference in performance. The second method compared the average rate of the horizontal or deviated well with that of the offsetting vertical wells for the same calendar time period. A value greater than one indicates that the horizontal or deviated well produced at a higher average rate than the average offsetting vertical well over the same time period. While clearly evaluating different performance measures, both methods gave similar overall results.

3. The difference in the performance of horizontal or deviated wells compared with offsetting vertical wells varies dramatically. Based on the available data, there does not appear to be a strong correlation to geographic location within the San Juan Basin. Based on the performance index defined above, the 17 horizontal wells exhibited performance indices ranging from zero (complete failure) to 7.5, with an average of 1.6. Based on the comparison of average horizontal well rate with the rate of offsetting vertical wells over the same time frame, the variation was 0.1 to 5.1, with an average of 1.3. For the 13 highly deviated wells examined in this study the performance indices varied from 0.2 to 1.4, with an average of 0.8. Based on the comparison of average highly deviated well rate with the rate of offsetting vertical wells over the same time frame, the variation was 0.2 to 1.5, with an average of 0.9.

4. Horizontal or highly deviated CBM wells generally cost between two (2) and four (4) times that of vertical wells to drill and complete. Production and reserves increases have not been commensurate with these increased costs. The average horizontal well exhibits an improvement over offsetting vertical wells of between 1.1 and 1.6 times the average maximum annual rate and estimated ultimate recovery (EUR). On the other hand, the average deviated well has exhibited poorer performance, exhibiting maximum annual rates and EURs of between 80 and 90 percent of the offsetting vertical wells. These conclusions regarding performance are based on a statistical analysis of wells in the San

Juan Basin and do not reflect a detailed technical analysis of each non-vertical well cited in this study.

5. Two wells drilled recently by CDX Gas have provided very encouraging performance improvement compared to offsetting vertical wells. The Penrose 1R in Section 8-R32N-R6W of La Plata County, Colorado was initially completed June 2002 but experienced mechanical difficulties requiring substantial time and resources to remedy (some of the problems may have been with surface or facility issues). However, in the second half of 2003 the Penrose 1R gas rate increased to 2.2 MMCFD and reportedly remains substantially choked back to avoid reservoir drawdown that could precipitate hole problems in the laterals. The Anderson 1R in the adjacent Section 5 was completed in December 2002 and apparently had similar mechanical difficulties to that of the Penrose 1R. However, these problems also seem to have been corrected as the Anderson 1R exhibited an increasing rate in the second half of 2003 reaching a stable rate of approximately one (1) MMCFD. These CDX well rates compare with offsetting vertical well rates of about 100 to 300 MCFD, or 10 to 20 percent of the CDX wells. Although CDX has not provided many details concerning these recent horizontal wells, they are believed to employ one or two sets of 'pitchfork' laterals, each pitchfork having three laterals located 650 feet apart from one another and extending about one-half mile into the reservoir. While these two CDX wells appear very promising, more information and production history is required to confirm their potential.

6. Detailed analysis is needed to address variations in economic viability of horizontal and deviated wells in different parts of the San Juan Basin. The basin clearly exhibits areas where there are several substantial coal seams that may require multiple laterals to exploit and the statistical comparison used in this analysis may not provide an accurate assessment of the development potential using horizontal wells. In addition, the wide variation in performance of horizontal wells in the San Juan Basin suggests that there are many factors, including geologic heterogeneity, influencing performance. Therefore, there is no general application for horizontal wells to the development of the Fruitland Coal in the San Juan Basin. Because of the variation of these many factors locally throughout the basin, the feasibility must be evaluated on a location by location basis as the success of any particular horizontal well appears to be highly site specific.

7. Horizontal drilling in San Juan basin is currently experiencing an increased level of interest by a number of oil and gas operators. A series of new wells ranging from low deviation to multi-lateral horizontal have been recently drilled in various parts of the Basin. These activities are driven by the potential that horizontal wells can be superior to vertical wells in both increased production rate and reserve addition while at the same time reduce the environmental impact associated with higher density wells. Although the evidence to-date is mixed regarding the rate and reserve benefits of horizontal wells, operators seem optimistic that additional technical breakthroughs and production history will demonstrate that horizontal and highly deviated wells will become an economically viable option as an alternative to conventional vertical wells in the Basin. At the current level of research and development by various operators in San Juan Basin, it is

anticipated that major breakthroughs and better understanding of horizontal drilling technology may be achievable within the next 2 to 5 years.

8. Technical uncertainties in deviated wells increase rapidly when the angle of deviation exceeds 30 to 35 degrees from vertical. San Juan Basin operators seem to have developed expertise to manage lesser deviated wells; however, wells with these limited deviations do not offer a significant advantage in reducing the environmental impact associated with higher density (smaller well spacing) development.

9. Within the industry, there appears to be very little disagreement that a successfully drilled and optimally operated horizontal well could significantly increase rates and reserves in comparison with vertical wells drilled in the same coal. Modeling work performed by several authors indicates an expected performance (rate and reserves) increase with horizontal wells in the range of two (2) to six (6) times that of a vertical well. These increases have not yet been consistently realized in the San Juan Basin CBM. Horizontal wells drilled within the last two years have so far shown folds of increase in rates very much consistent with these modeling and simulation forecasts. If these rates can be maintained, significant economic and environmental benefits can be achieved over a short period of time. However, as indicated above a number of technical problems, including wellbore stability and plugging due to coal fines migration will have to be remedied.

5.0 DISCUSSION

5.1 Literature review of horizontal and directional wells in coal

The focus of this literature review is to present historical progress and developments made on horizontal and directional drilling technology in coal with an emphasis on production rate and recovery of reserves. Detailed reference locations for literature cited in this review are provided following the report text. Two distinct applications for horizontal drilling in coal have been reported in the literature. In the mining industry, horizontal boreholes have been used extensively to degasify coal seams with a dual intent to capture gas for sales and to enhance mine safety. In the oil and gas industry, horizontal wells have been used less frequently to increase gas production from deep, un-minable coals and to reduce surface disturbance associated with mining operations. Considerable learning and experience acquired via horizontal borehole drilling in conventional mining operations have contributed significantly to the advancement of horizontal drilling technology in deep coal bed methane reservoirs.

Drilling horizontal segments from an existing vertical wellbore is not a new idea and, in fact, the first patent for equipment to place a horizontal drain hole from a vertical well was granted in 1891. The first truly lateral hole was drilled in 1929 in Texas and since then horizontal drilling technology has been improving in both performance and reliability.

Horizontal borehole drilling for coal seam degasification was implemented for the first time in the United States in 1958 (Thakur and Poundstone 1980). Nowadays, such a drilling activity usually occurs up to several years ahead of the actual mining activity due to improvements in directional control and economics. In addition to potentially producing a significant amount of methane over an extended period of time through these horizontal boreholes, mine safety has also been improved considerably by reducing methane emissions into mines.

In a paper published by Diamond et al. (1980), the authors describe the details of a pilot project in the Emerald Mine (near Waynesburg, Pa) aimed at improving directional drilling technology. Three long horizontal degasification holes were drilled in the coal from a directional borehole. Furthermore, a single vertical borehole was drilled for coalbed dewatering followed by seven additional vertical boreholes to monitor the progress and extent of degasification process with time. The project was able to demonstrate that the technique of directional drilling can be used to degasify coalbeds, and that reasonably long horizontal segments can be practically drilled in deeply buried coals. Drilling techniques developed in this pilot project have served as the basis for continuous improvement up to the present time.

A successful pilot project was also conducted in the Rocky Mountain area at the Soldier Canyon Mine of Carbon County, Utah (Schwoebel 1987). In this project, a total of 40 horizontal boreholes (over 65,000 feet of cumulative length) were drilled into a 16-foot thick coal seam at a depth of 2,000 feet. Pipeline quality gas was successfully collected via an underground pipeline network.

In a theoretical study by Ertekin and Sung (1986), the authors presented a paper focusing on the production aspects of horizontal drainage wells for coal seam degasification using a multidimensional coal bed methane simulator. The model permitted evaluation of multiple horizontal boreholes originating from a common vertical shaft. Several important coal seam parameters were identified and different horizontal borehole completion schemes were studied in order to better understand the various factors that play major roles in methane drainage process via horizontal boreholes. Sensitivity runs were performed by changing such parameters as borehole diameter, penetration length and positioning of the borehole. One important finding of this study was that the expected ultimate recovery from a horizontal borehole drilled in a coal seam can be maximized over the producing life of the well if the borehole is oriented orthogonal to the face cleat. If only one borehole is to be drilled, it was recommended that it be placed in the upper part of the coal seam. Drilling two parallel horizontal boreholes in a thick coal seam at different elevations was shown to increase the gas production rate drastically with an associated increase in water production rate. Production rate was further increased with increased vertical conductivity within the coal fracture network. In this study, several simulations were run using borehole lengths of 300, 500, 955 and 1,910 feet. Production rate was observed to increase with length. Furthermore, model results indicated that during an initial production period, gas production rate was higher for the boreholes drilled parallel to the face cleat, however, as the production continued,

boreholes perpendicular to the face cleats became more powerful in transmitting methane to the wellbore and a cross over in production rates and ultimate recovery occurred.

In a paper published by Logan and Schwoebel (1987) on the application of horizontal drilling technology for coal seam gas recovery, the authors tried to justify the viability of such a drilling technique by arguing that due to low permeability, coal reservoirs usually require hydraulic fracture stimulation to achieve economic production levels. Hydraulic fractures in vertical wells usually propagate parallel to the maximum stress (or permeability) direction; therefore they may not adequately drain an anisotropic reservoir. A more effective stimulation technique, therefore, is a horizontal borehole placed perpendicular to the face cleat direction, thereby providing maximum access to the primary flow channels.

In this paper, the authors classified horizontal wells into four categories: (a) very short radius -- 1 to 2 feet (b) short radius -- 35 to 45 feet (c) medium radius -- 300 to 500 feet, and (d) directional -- 1800-2800 feet radius. In a project called "Deep Coal Seam Project", they describe drilling and production results for 2 vertical and one short radius horizontal well in the Piceance Basin. The horizontal well was designed and drilled specifically to be placed perpendicular to the maximum permeability or face cleat direction. The paper provides a detailed account of operational issues when placing a short radius horizontal well in a coal seam. They also discuss the details of drilling technique, tools and wellbore stability issues, which they considered to be of primary importance. At the time the paper was published the horizontal well was undergoing initial testing and no further information on the performance was available.

In a later paper published by Logan (1988), the author discusses the application of a medium range horizontal well in the Rocky Mountain region. Similar to the previous paper, the technical details on the use of various types of equipment and drilling procedures are fully discussed. One conclusion reached in this study is that the short radius drilling technique lacks the accuracy needed for azimuth and inclination control whereas the medium-radius technique has the ability to place a long horizontal well on target.

In a paper published later by Deimbacher et al. (1992), the authors argue that in coalbed reservoirs, permeability is usually highly anisotropic, with the maximum permeability invariably along the maximum horizontal stress. Similar to Logan et al., they hypothesized that when a vertical well is hydraulically fractured, the fracture propagates parallel to the maximum permeability direction. However, this is highly undesirable from production standpoint when the bilinear flow concept would necessitate a large permeability normal to the fracture face. These authors used numerical simulation techniques to show that horizontal wells drilled in the orthogonal direction (i.e. normal to the maximum permeability and the main natural fissures) can provide significantly larger gas rates than equivalent vertical wells. Furthermore, several small hydraulic fractures placed in the horizontal well with proper zonal isolation can further increase the well productivity. The authors claim that considering the highly fissured, cleated nature of

coal beds, small stimulations in horizontal wellbores are far easier to perform than a single treatment in vertical wells.

Other conclusions reached in this study indicate that although length of the horizontal well is quite important in increasing production rate, its positioning is relatively unimportant in thin coal seams. Furthermore, horizontal permeability anisotropy plays a critical role in comparing the performance of a fractured vertical well with that of an unfractured horizontal well. The larger the anisotropy, the more attractive the horizontal well will be compared with the fractured vertical well. Horizontal wells are particularly suitable when the horizontal to vertical permeability ratio is small (i.e. good vertical communication, as in naturally fractured formations). The thinner the formation, the more it will favor a horizontal over a vertical well. For thin coal seams the vertical to horizontal permeability anisotropy is relatively unimportant, however, the anisotropy in the horizontal plane is far more critical. From the results of the simulations performed, the authors claim that a qualitative knowledge of the permeability anisotropy is essential before the well is drilled. Actual knowledge of the magnitude of such anisotropy is essential for proper design and sizing of the well. Furthermore, in comparing the fractured vs. non-fractured horizontal well and fractured vertical well, the paper reports that an unfractured horizontal well drilled normal to the larger permeability in a highly anisotropic formation would result in an increase in productivity index between 75% and 100% over both the longitudinally fractured horizontal well and the fractured vertical well.

Unrelated to coal reservoirs, the work published by Caldwell and Heather (1991) discusses horizontal drilling in the Austin Chalk formation (South Texas). The authors claim that the conclusions reached in their study are equally applicable to coal reservoirs due to similarities in fracture distribution between tight gas and coal formations. In the Austin Chalk, horizontal wells have enjoyed significant success in areas already considered depleted by vertical wells. Detailed analysis of the vertical wells in the area indicated two groups of wells with significantly different estimated ultimate recoveries (EUR's). The authors have attributed this difference to the communication, or lack of it, between the wellbore and the in-situ fracture swarms. Horizontal drilling has the effect of substantially improving not only the chance of encountering multiple fracture swarms but also several fracture swarms may be intersected in a single wellbore. The paper states that EUR'S for the horizontal wells in the study area averaged 119 MBO while the fracture stimulated vertical wells averaged 55 MBO.

The work by Sarkar and Rajtar (1994) further improved on horizontal well technology by developing type curves applicable to coal bed methane reservoirs for transient well testing. Through this type curve matching process, both reservoir and sorptive characteristics of coal can be quantified. The authors present an equation which they claim to be the most general pressure response equation for single phase flow in a semi-infinite CBM reservoir.

A paper by Osisanya and Schaffitzel (1996) brings to focus similar ideas expressed previously regarding the horizontal well drilling in coal. They state that the properties of

a coal bed essential to its completion methodology are dual porosity, permeability, gas desorption, stratigraphy, bottomhole pressure, and water production. Vertical wells can not be economically justified without fracture stimulation, however, horizontal wells are considered to be very effective in reservoirs that are relatively thin, naturally fractured, and known to have anisotropic permeability which is the case in most coal reservoirs.

Permeability anisotropy, particularly in thin seams, plays an important role in the performance of horizontal wells. As found previously, the horizontal section of the wellbore must be drilled perpendicular to the face cleat, or the greatest permeability to achieve highest production rate possible. Prior to initiating a drilling program, several core samples should be tested to determine the minimum and maximum stress directions and to determine how weak and friable the coal is to ensure wellbore stability. The paper also discusses additional practical guidelines with regard to the drilling aspects of horizontal wellbores.

In comparing changes in well productivity, a US Bureau of Mines report has shown through simulation studies that a properly drilled and completed horizontal well can increase gas production by about 75% over that of a fractured vertical well (Ertekin and Sung 1986).

Chi and Yang (2000) discuss a conceptual methodology for drilling a network of horizontal wells in coal reservoirs. Two patterns of "net" and "twig" are described. In the former, multiple horizontal wells are drilled to form a square grid. The latter is made up of multiple horizontal wells in parallel where each well (main trunk) may contain multiple branches in forming the network. The author claims that these drilling patterns, although not practically verified yet, can be very promising for many low permeability, low pressure coal bed methane reservoirs in China which have not responded economically to vertical drilling.

A recent paper authored by Chaianansulcharit et al. (2001) reports on the impact of permeability anisotropy and pressure interference on CBM gas performance. Although the paper does not explicitly discuss the type of completion, it states that the most optimum drainage pattern for CBM field development is one of rectangular shape rather than a square shape. Determination of the optimum drainage aspect ratio and orientation, however, requires knowledge of the orientation and degree of in-situ permeability anisotropy. In the case of horizontal wells, the well productivity will be even more dependent upon pattern spacing, aspect ratio and permeability anisotropy.

A paper by Sams et al. (2002) describes a generic coal field sequestration/enhanced coal bed methane project using horizontal wells as producers and injectors. The authors argue that the increased rate and recovery by horizontal wells relative to vertical wells is due to better connectivity of the wellbore with reservoir rock (in this case coal). In this simulation study, the length of the injection lateral was varied between 300 and 1,000 feet while that of the producing wells was kept at 3,000 feet. Investigators found that the injector length can have a significant effect on the volume of carbon sequestered. In almost all cases studied, they found that the most optimum length of a horizontal well

which yields maximum CO2 sequestration is in the range of 300 to 600 feet (as opposed to 1,000 ft). An indirect conclusion from this study is that productivity of a horizontal producer (rather than an injector as shown in the paper) should be optimized by varying the length of the horizontal segment. This optimum length is strongly influenced by the reservoir and other operational parameters.

A paper by Jan et al. (2002) describes the development and testing of an improved coalbed reservoir simulator. A coalbed methane well in the fairway region of San Juan Basin was used for history matching as a test case (actual well name and location have not been provided). The well was originally a vertical well which had been producing for five years before being side tracked and converted to a horizontal well. The vertical well was fractured in the Fruitland upper and basal coal intervals. The horizontal section of the well was approximately 1,200 feet in length (open hole) and was producing from the Fruitland basal coal section. The horizontal section was fractured with an estimated fracture length of about 215 feet. When the well was simulated only as a vertical well, its cumulative gas production was predicted to be about $1/6^{th}$ of the actual recovery observed by the well after the addition of the horizontal side track.

5.2 Comparison of vertical, deviated and horizontal well performance in San Juan Basin

An important element of the current study involved developing a methodology whereby the production behavior of horizontal and deviated wells at different locations in San Juan Basin could be compared with vertical wells. Given the scope of the project the analysis needed to use readily available data and information to make basic performance comparisons. MHA adopted two different methods; the first approach examined maximum sustained rates over a one year period and estimated ultimate recovery (EUR) for each of the wells in the comparison database. The second method compared producing rates between the vertical and non-vertical wells over a common time frame. Each of these methods has technical shortcomings, but in the aggregate the comparisons are consistent and provide a meaningful summary of the success of horizontal or deviated well drilling in the San Juan Basin to-date.

Using the IHS Energy Database a query was made to identify all non-vertical wells completed in the Fruitland coal by selecting for the keyword "hole direction", either "deviated" or "horizontal". From a total of nearly 5100 wells, this search resulted in identifying 17 horizontal wells (**TABLE 1**) and 174 deviated wells in the Fruitland Coal (**TABLE 2**). Of the 17 horizontal wells, only five contained detailed directional survey information that specifies measured depth (MD), true vertical depth (TVD), drift angle and azimuth. Furthermore, of the 17 horizontal wells, seven have been drilled as new wells, while the rest are horizontal laterals drilled off of an existing vertical trunk. In analyzing the performance of these wells, as will be discussed later, the second of MHA's analysis approaches considered only the time period after the horizontal section was drilled since IHS reports both the original and the horizontal re-drill production rates under the same API number. In the horizontal well group, the measured depth ranged

from 2,809 to 8,539 feet with an average of 4,488 ft. The average reported TVD within this group was 3,470 ft. Hence, the average measured depth for the horizontal wells was 1,018 feet longer than the TVD average.

For the group of wells designated as "directional", 46 out of 174 wells contained information on both MD and TVD. Of these, 22 wells contained details of directional survey. The measured depth of these wells varied between 746 and 7,410 feet with an average of 3,328 ft. The average reported TVD for this group was 3,098 feet and, hence, the measured depth for the directional wells was only 230 feet longer than TVD average as compared with 1,018 feet for horizontal wells. In this study, we identified the "highly deviated" wells as the 13 wells with a difference between MD and TVD greater than 300 ft. These 13 deviated wells are listed in **TABLE 3**.

To compare the performance of horizontal and directional wells with vertical wells on a common basis, MHA first identified the section land in which a particular horizontal or deviated well (using the reduced dataset of deviated wells in **TABLE 3**) has been drilled. A second search was subsequently performed to identify all other vertical wells located in the same section. (For one particular horizontal well, there were no vertical wells within the same section so wells from adjacent sections were selected.) The number of offset vertical wells for each non-vertical well ranged between one and five. **TABLE 4** provides a list of all of the wells derived from these queries and represents the 'comparison dataset' of 101 wells.

MHA's first comparison involved analyzing the production behavior of each well to determine the maximum sustained monthly producing rate, which was defined for this study as the maximum annual production divided by 12. In addition, MHA performed a decline curve analysis to project remaining gas production and thereby determine the EUR, which is equal to the cumulative production and the remaining reserves. (**Appendix A** shows a semilog rate versus time plot with the production forecast for each of the wells in the comparison dataset.) Based on observation of the production behavior for wells in this comparison dataset and experience in the San Juan Basin, a minimum effective annual decline of 10 percent was used. This decline rate was also applied in cases where there was not an established decline. This minimum decline was adopted because it imposed some consistency in the extrapolation of performance, and because it was not within the project scope off work to perform a detailed analysis of production performance that was not exhibiting an established decline. The exceptions to these decline curve analysis guidelines were CDX's two recent wells, the Penrose 1R and Anderson 1R. Both wells consist of multilateral horizontal legs and exhibited significant rate increases through the second half of 2003. Both wells are reported to be producing currently at stabilized rates reflecting relatively low drawdowns. Therefore, reserves for the Penrose 1R and Anderson 1R were forecast assuming three years of production at constant rates equal to the rates as of November 2003, and then were forecast to decline at an average annual effective rate of 25 percent. These forecasts were based on the prospect that the wells would continue to produce at below-capacity rates in order to avoid drawdowns that might cause wellbore instability. Once the reservoir pressure reaches a point where the wells can produce safely against the line pressure the decline

rates will be larger than those of vertical wells because the reservoir will be depleting more rapidly to a lower abandonment pressure. Clearly, with the limited production history and the assumptions inherent in their forecasts, the reserves for these newer CDX wells have a larger than normal uncertainty in their estimate.

TABLE 5 is a detailed summary of the maximum rates and EURs for the comparison data set. Since the wells are distributed throughout the San Juan Basin, **TABLE 5** indicates that there is a wide variation in the results, with maximum rates ranging from less than economic rates of about 300 MCF per month to as much as 310,000 MCF per month, and EURs varying from less than 10 MMCF to more than 27,000 MMCF. A relative performance index was determined by taking the ratio of the maximum rate and EUR for horizontal or deviated well within a particular section to the average maximum rate and EUR for the offsetting vertical wells. The ratios of the rates and EURs were equally weighted to derive the so-called performance index (see equation in Note on **TABLES 6 and 7**).

TABLE 6 shows the resulting performance index comparisons for the horizontal wells and indicates that they range from complete failures (a performance index of zero) to highly successful (as indicated by a performance index of 7.5). The average performance index is 1.6, which indicates that in the aggregate the EUR and maximum annual rate of the horizontal well is 1.6 times that of the offsetting vertical well(s). It is important to note, however, that the very recent performance of the two CDX wells, the Penrose 1R and Anderson 1R, which have performance indices of 7.5 and 2.2, respectively, significantly influence this average. Excluding these two well, the average performance index is 1.1. This is important to understand because these two wells have very little production history upon which to base a maximum annual rate and EUR. **TABLE 7** shows the results of the performance index analysis for the deviated wells and indicates that the outcome ranges from failure (performance index of 0.1) to some improvement (performance index of 1.4). However, the average deviated well with a performance index of 0.8 has exhibited a lower maximum annual rate and is expected to recovery less gas than the offsetting vertical wells. These comparisons can be visualized by inspection of the plots in **Appendix B**, which show for each of the comparison well sections semilog plots of gas rate versus time for the horizontal or deviated well and the offsetting vertical wells. The first of these plots for each section shows the data in 'real time' (as the wells were drilled and produced) and in 'normalized time' (where each well begins producing from the same time zero).

The variation in performance for the horizontal and deviated wells is illustrated in **FIGURES 1 through 4**, which show the production performance for the horizontal wells in the Colorado and New Mexico portions of the San Juan Basin, respectively (**FIGURES 1 and 2**), and the performance of the deviated wells in the same geographic divisions (**FIGURES 3 and 4**). As indicated earlier, some of the horizontal wells were originally vertical wells (**TABLE 1** indicates the completion dates of the horizontal well segments). While this condition would influence the performance index comparison described above, incorporating its influence in this analysis would not change the general conclusions reached. In other words, horizontal drilling has generally produced wells

that exhibit higher rates and reserves than offset vertical wells, but there is a wide variation in horizontal well performance and the average horizontal well performance does not represent an improvement over a vertical well commensurate with the increased drilling costs.

MHA's second performance comparison consisted of calculating the average rate for the offsetting vertical wells over the same time interval as the producing period of the horizontal or deviated well. **Appendices C and D** contains plots of rate vs. time showing for each horizontal (**Appendix C**) and deviated (**Appendix D**) well the relevant time and rate comparison. **TABLES 7 and 8** compare the average rate between the horizontal and deviated wells, respectively, and their offsetting vertical wells. **TABLE 7** indicates that in approximately 70% of cases, the horizontal wells performed poorer than the offset vertical wells by an average of 470 MCFD. For the remaining 30% of the cases where the horizontal wells did better than the offset vertical wells, the average rate increase was about 1125 MCFD. Analyzing the data using average rate ratio instead of rate difference, it was found that the ratio of horizontal well average rate to that of offset vertical well varied between 0.1 and 5.1 with a mean of 1.3. **TABLE 8** shows that in the case of deviated wells about 40% of these wells did better than the offset vertical wells with an average rate increase of 350 MCFD. For the other 60% where deviated wells performed worse than the vertical offsets, the reduction in rate averaged at about the same level of 350 MCFD. The average rate ratio of deviated to offset vertical wells showed a range of 0.2 to 1.5 with a mean of 0.9.

5.3 Feedback from Operators

In an effort to capture the opinion and current position of San Juan Basin operators concerning horizontal or deviated wells, MHA interviewed representatives of several companies, getting input from technical and management staff. The level of cooperation in providing detailed information ranged from none to substantial. A summary of such discussions is presented below.

Within the past two years, six horizontal CBM wells have been drilled in the San Juan Basin by two companies, CDX Gas and Williams Production Company. CDX drilled two wells offsetting Petrox's Tiffany Field, and Williams drilled four wells in New Mexico. As discussed below, the companies' have very different approaches and associated costs.

CDX Gas has acquired multiple patents for developing a new horizontal drilling and completion system known as the Z-Pinnate process. The method is intended to maximize gas production rate and ultimate recovery from coal seams in less time and with less environmental impact than traditional drilling methods. The company claims that this process can drain up to 1200-acres from a single drill pad. To develop an equivalent area with conventional vertical drilling would require 16 well sites (New Technology Magazine: Oct/Nov 2003). Furthermore, even in low-permeability coal bed formations, CDX claims that its Z-Pinnate horizontal drilling and completion system can recover

80% to 90% of the methane in-place, compared to just 10% to 70% using conventional technology.

CDX has not yet applied the specific Z-Pinnate drilling technology in the San Juan Basin, but to test the concept of improved multilateral drilling, CDX has drilled two multilateral horizontal wells in the San Juan Basin Fruitland coal formation. In both cases, the casing in the vertical section was milled across the coal interval and the hole was under-reamed or cavitated. The horizontal sections intersect the vertical section in the milled and under-reamed area and then extend out one-half to two-thirds of a mile. Based on available information, it is not clear if both wells have employed the same multilateral configuration, but it is believed that the surface locations are basically near the center of a quarter-section with the laterals extending into the center of the adjacent quarter-sections, thereby developing a spacing unit of between 320 and 640 acres.

The first well, Anderson #1R, was drilled in Section 5-32N-6W, La Plata County, Colorado, without fracture stimulation at a cost of $1.3 million ($MM). (This cost is approximately 4 times the typical drill and complete costs of the average $320,000 for wells on the Colorado side of San Juan Basin.) The laterals have a total horizontal length of 9,000 feet and were designed to drain a minimum of 320 acres in an area where existing vertical wells have an average production rate between 100-200 MCFD. The targeted coal has an average thickness of 12 feet. Initial production rate for this well was measured at 1.2 MMCFD against a relatively high wellhead flowing pressure of 700 - 800 psi, and a flowing bottomhole pressure in excess of 1000 psi. Shortly after production, the well experienced problems due to coal fine migration into the wellbore. However, after expensive clean up and liner installation the production rate once again increased to 1.6 MMCFD at the same wellhead and bottomhole flowing pressure conditions. However, in order to mitigate the plugging problem associated with fine migration, the well was choked back to a rate of between 600 and 700 MCFD for the latter part of 2003 and has subsequently been without any apparent production problems. The average daily gas production rate for this well (API# 05-067-08746), as shown in **Appendix C**, appears to be much higher than the average of vertical offset wells within the same section. In summary, while the well does show increased productivity, the primary benefit of increased flow rate from the horizontal laterals has been somewhat mitigated by the need to operate the well below its ultimate production potential in order to prevent fines migration and costly future cleanup.

The second well, the Penrose 1R located in La Plata County, Colorado, is an offset to Anderson 1R in Section 8-32N-6W and initially produced at a choked-back rate of 1.3 MMCFD from a 10-ft coal seam. Due to experience with coal fine problems observed earlier, a production liner was installed from the beginning. Total drainage area of this well is estimated to be around 240 acres as some of the coal seams begin to thin out around the edges of the section. The well has a 'pitchfork' type of multilateral system with three horizontal laterals extending more or less in the same direction but 650 feet apart from one another. It is unclear whether there are one or two sets of these 'pitchfork' multilateral sets of wellbores; if the intent is to drain 640 acres, it is likely that there are two such sets of multilaterals but this could not be confirmed with information

available in the public domain. Again, the total drilling and completion cost of this well was reportedly about $1.3MM. After producing for about two months at the rate mentioned above, this well also experienced severe plugging problems due to coal fine migration and was cleaned out once with coiled tubing. At some point during (or shortly after) a two week shut-in for construction and maintenance of the sales line, the laterals apparently collapsed. After three and a half months of workover production was restored and CDX has slowly opened the well, increasing the rate to about 2.2 MMCFD in November 2003. Although both the Anderson and Penrose wells are flowing into a line pressure of around 100 psi, the wells are believed to be choked back to flowing tubing pressures of approximately 400 psi. CDX Gas has selected two additional sites to drill similar wells in the San Juan Basin, each with a drainage area in the range of 480 to 640 acres.

CDX has recently drilled a third horizontal well in New Mexico near the HD Mountains. The well has a total vertical and horizontal length of 8,000 ft overlaying a 320 acre spacing unit. This well, however, has not performed nearly as well as the previous two wells described above. CDX speculates that this well may be suffering from liquid loading in the horizontal section as some of the CBM wells in this area produce up to one barrel of liquid hydrocarbon per day. Currently this well is producing at a rate of 50 MCFD. It is interesting to note that a conventional horizontal well drilled in the same section and operated by Conoco-Phillips is currently producing at about 200 MCFD from a 1,500 ft horizontal section.

In summary, although the increase in gas production rate for the CDX wells compared to offsetting vertical wells is substantial, remedial operations following drilling have been expensive and it is likely that additional sustained production will be required to confirm that CDX's technology has significant and widespread application in the San Juan Basin. Certainly, recent performance data indicates that both the Anderson and Penrose wells have been operating in a stable manner with rates approaching their initially designed targets. This is certainly encouraging if such a novel technique should find widespread acceptance by other operators for recovering significant volume of gas from environmentally sensitive areas of the San Juan Basin. One area of remaining uncertainty is that at this point in time it is not known how these types of wells will perform in areas of higher coal permeability where conventional vertical wells have been shown to adequately drain larger areas at high rate by targeting multiple coal seams.

Although Williams Production Company declined to provide direct input to this report, information obtained from other sources indicates that its horizontal drilling technique is 'conventional' and therefore simpler and less risky than that used by CDX. William's application involves drilling a single lateral 1,000 to 1,500 feet in length that is cased with a 4.5" slotted liner. The company drilled 4 wells in 2003, one collapsed but the other three wells are currently producing at rates of 280, 500 and 600 MCFD. Williams claims that its wells take less time to drill than conventional coal wells with cavitation, and that it takes between seven and 10 days to construct a well and its horizontal leg. The well cost is in the range of $600,000 to $800,000 which is the same as a conventional well with cavitation. An additional five to seven wells are planned for 2004 using locations

that are close to ¼ section lines and utilizing existing pads to avoid new road construction and surface impacts.

BP America provided valuable input with regard to its experience in both horizontal and directional drilling in the San Juan Basin. Currently, BP views this technology as still maturing; encouraging and having some good results but also having plenty of documented failures. In it's view, the well performance in the context of the risk of mechanical failures and costly repairs and does not compare favorably with the higher drilling costs.

BP believes that there are a number of technical challenges facing horizontal drilling in coal. The most important one is wellbore stability. In the horizontal section, the hole can potentially come in contact with large fractures in a low stress environment, resulting in coal collapse and the loss of the hole. A second important problem, as CDX has experienced, is keeping the hole clear of coal fines which are difficult, time consuming and expensive to remedy, particularly in the horizontal section of the well. In vertical wells, this problem is generally remedied by installing a perforated liner along the coal face. In a long horizontal well, however, it would be very difficult and quite challenging to install such a liner over the entire horizontal section. Furthermore, even if a liner can be installed partially into the horizontal section, at some point into the life of the well the hole needs to be cleaned out and the technology for doing the cleanup for a long, horizontal liner has not yet been fully developed. A third potential problem for horizontal wells in areas with high water and/or moderate liquid hydrocarbon production is unloading the well (i.e. removing the accumulated liquids from the bottom of the well). Dewatering the coal is the primary mechanism for gas desorption from the internal surfaces of the coal. For wells with moderate water production, downhole electric pumps can be used to pump the water through the horizontal section and into the primary wellbore. However, the use of rod pump and issues related to moving the equipment through the vertical bend poses serious challenges given the current state of technology.

Another challenge facing the operators is finding areas where reservoir rock properties and geologic settings are favorable for horizontal drilling. For instance, in the fairway region of San Juan Basin (New Mexico) where the coals are more permeable and have higher fracture density, the stress environment is such that horizontal wells have a higher probability of experiencing mechanical failure than in the tighter regions further north in Colorado. However, these northern regions have historically been producing at a much lower rate than the Fairway wells, which brings into focus the issue of risk and potential reward in horizontal drilling. In addition, horizontal wells can be drilled more economically if the majority of the gas is stored in a single, thick coal seam with significant lateral continuity. The eastern portion of the Northern San Juan Basin EIS study has lower permeability, but relatively thick coal in two distinct coal intervals. The western portion of the area, however, has very different geological characteristics from the eastern area and is characterized by multiple distinct coal seams. BP has provided a set of cross sections (see **Appendix E**) highlighting variability in coal seam distribution and lateral coal across the basin. The impact of reservoir geology on the long term performance of horizontal wells in San Juan coal has not yet been fully evaluated.

BP also provided valuable comments with regard to drilling, completion and production of directional coal wells in the San Juan Basin. The company is currently utilizing directional drilling to the extent possible for downsizing to 160 acre spacing in its infill drilling project. Based on BP's comments, it appears that wells with deviation angle greater than 30 degrees face more difficult technical challenges than those drilled at less than 30 degrees. In this case, the deviation angle is dependent upon the distance measured from the center of a quarter section (bottom hole location of infill well) to the new well surface location, or to an existing drill pad. For instance, a deviated well drilled at the center of a quarter section will require an average deviation angle of 45-50 degrees versus 25-30 degrees if the well is drilled offset to the center by 700 ft.

As part of their infill drilling program, BP has drilled 10 deviated wells within a year where the majority of wells have deviation angle in the range of 25-30 degrees. Only one well has a deviation angle exceeding 45 degrees. No major difficulty was encountered in the drilling process relative to conventional vertical wells, even for the highest angle well. However, areas where significant technical challenges remain to be addressed are in completion and production optimization. Fracture stimulation appears to be problematic for the higher angle wells but not so much for the low angle wells. Although there appears to be good control in executing the fracture treatments for even the most deviated well, well performance suffers (in relative terms and in comparison with vertical wells subject to similar fracture treatments) as the deviation angle increases. It is not clear at this time why a highly deviated well can not be as effectively stimulated as a regular vertical well. Some speculation as to the cause can be made in the way hydraulic fractures connect with the natural fracture system in the coal. To compensate for the less effective fracture stimulation and higher gravitational effect, wells with deviation angle exceeding 30 degrees appear to have an increased need for artificial lift compare to nearby vertical wells. Removing water from a slanted well requires additional energy as compared to a vertical well having the same depth. Alternatively, without such artificial lift, the well has to produce at somewhat higher rate to compensate for the negative effect of gravity.

From a financial point of view, BP believes at this point in time that the savings realized by the use of an existing pad for drilling a deviated well may be compromised by the additional costs for artificial lift, and by the lower production rate due to less efficient fracture stimulation. This has a negative impact on the economics of high angle wells. Furthermore, particularly for highly deviated coal wells, BP's limited experience indicates that these wells may require longer time to stabilize after they come on production due to longer clean-up time (as high as one year) as compared to less deviated wells (< 25-30 degrees) and/or vertical wells (with cleanup times of three months or less). The company is currently analyzing the performance of these newly drilled deviated wells while evaluating alternative fracture stimulation and production optimization techniques. If some of the above-mentioned technological challenges can be resolved successfully, the cost saving and the reduced environmental impact on the surface will make deviated well drilling a potential alternative to vertical drilling for the ongoing basin-wide infill drilling program. However, BP believes that it may take another year to fully evaluate the performance of the deviated wells.

Another company which provided information for this report was Petrox Resources Inc. (Petrox). Petrox is one of the companies proposing selective horizontal drilling in the eastern portion of the EIS study area in Archuleta County; however, it has expressed concern that at the present time a large scale horizontal drilling project in the Basin will have a difficult time attracting pipeline companies to invest in surface infrastructure as they perceive this technology as having too much uncertainty, which compromises production forecasts. Petrox estimates four to five horizontal wells with single laterals will be required to drain a section effectively. They plan to monitor the performance and use history match models to predict long-term production. The company anticipates at least three to five years for gathering data and solving operational problems associated with horizontal drilling. An alternative approach Petrox is considering is to initially drill conventional vertical wells (downsizing from 320 to 160) using a larger casing (larger than 9-5/8 inch) so that horizontal segment can be added at a later time. This can be accomplished by setting a whipstock over the coal section and drilling laterally into the coal. Alternatively, a pre-milled window system can be used to drill a short radius horizontal wellbore into a coal seam, although at a significantly higher cost that may be prohibitive at this time.

Petrox believes that for small operators with limited drilling budgets, a primary concern with implementing horizontal well technology is securing financing from commercial banks since horizontal drilling in the San Juan Basin is viewed as a relatively high risk investment with limited performance and reliability history. Higher drilling and maintenance cost as compared to conventional vertical wells are also considered by small operators to be an impediment in pursuing this technology due to their limited financial strength.

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Appendix E

Well Field Development Activities Common to all Alternatives

Appendix E — Well Field Development Activities Common to All Alternatives

E.1 Preconstruction Phase

The company will generally submit a Notice of Staking to the Bureau of Land Management (BLM) or BLM and the Forest Service (FS) to begin the well development process on federal leases. The document identifies the operator, the surface location of the proposed well, the target geologic formation, the depth of the well, and the lease parcel number. A map accompanies the Notice of Staking. The map shows the location of the proposed well and access road in enough detail to locate the proposed action on the ground.

An on-site meeting is held to review the proposal after the operator has located and staked on the ground. The operator and agency representatives, which include needed natural resource specialists, review the proposed action at the on-site meeting.

At the end of the on-site meeting, the operator is generally advised of the specific surface protection measures that will be required to mitigate the potential effects of the proposal.

The operator then submits an Application for Permit to Drill (APD). When the required environmental analysis is complete, the APD is either approved with conditions and a surface use plan of operations is attached, or the APD is rejected. If it is rejected, the company must revise its plans and submit a new APD to the agency for consideration.

E.2 Construction Phase

This section describes the overall procedures, techniques, and resources the companies would use to construct access roads, well pads, and ancillary production facilities. The ancillary facilities include pipelines for gathering gas and produced water, electrical facilities, water disposal sites, and compressor stations.

E.2.1 Access Roads

Roads that access well sites would be constructed using a tractor dozer, tractor backhoe, road grader, and gravel trucks. First, the tractor dozer would roughly shape the general prism of each road. The tractor backhoe would then set culverts for drainage, burying them to a depth sufficient to ensure they would not be damaged or destroyed by future traffic. The grader would then begin final shaping of the road prism. Gravel trucks would transport both the coarser

subsurface gravel and finer surface gravel to the site to be graded on the road prism. The subsurface gravel would lend structural support to the soil, allowing use of the road during wet periods. The surface gravel would provide a covering that can be maintained without damaging the structural support of the larger gravel. The surface layer would not be applied until the larger subsurface material had been compacted. Compaction could be achieved by allowing other types of traffic to operate on it.

Table E–1 summarizes the vehicles and round trips anticipated for the construction, drilling, and completion described in this section.

E.2.2 Well Pads

Construction of the well pad would begin after the tractor dozer had roughed in the access road to the well site. First, the topsoil would be stripped and stockpiled for reclamation. The reserve pit would generally be excavated on a cut side of the location. Generally, the pit would be 10 feet deep, 80 feet long, and 6 feet wide. For all jurisdictions, areas on the pad where heavy equipment would be used would be covered with gravel.

The associated disturbance would vary with the number of wells the companies expect to drill from the pad. Construction of pads where a single well would be drilled would result in an initial disturbance of 1.4 acres. The disturbance would increase by about 25 percent of the original 1.4-acre size with each additional directional well. Thus, pads for two directional wells would initially disturb 1.75 acres, and a pad for three directional wells would initially disturb 2.1 acres. The companies would reclaim the parts of the pad and reserve pit that are not needed for production after each well is drilled and completed. Based on CBM wells completed to date, about 0.4 acre of each pad would be reclaimed. The rest of the pad would represent long-term disturbance for the life of the project. The Colorado Department of Public Health and Environment (CDPHE) requires stormwater discharge permits for surface disturbance. These permits require development of stormwater management plans, which specify implementation of Best Management Practices (BMPs) for erosion and sediment control during runoff from disturbed areas if a 5-acre threshold for surface disturbance is exceeded as stipulated in current stormwater regulations applicable to oil and gas operations.

Table E–1 Summary of Vehicle Trips Needed for Construction, Drilling, and Completion of Wells Under the Alternatives

Facility/Activity	Frequency of Trips
Access Road and Well Pad Construction	
Haul Truck for Dozer	2/Well
Haul Truck for Grader	2/Well
Haul Truck for Backhoe	2/Well
Gravel Truck (20 Yard)	200/Mile of Road
Flatbed Truck for Rig-Up, Rig-Down	50/Well
Well Installation	
Well Drilling	
Truck Mounted Rig	1/Well
Support Trucking	32/Well
Casing Tong Truck	1/Well
Water Truck	25/Well
Mud Truck	3/Well
Fuel Truck	2/Well
Rig Crews/Pick-Up	3/Day
Rig Mechanic/Truck	1/Well
Proponent Supervisor/Pick-Up	2/Day
Mud Engineers Truck	1/Day
Casing Haul Truck	2/Well
Cementers/Pick-Up	2/Well
Bulk Truck	3/Well
Loggers/Logging Truck	1/Well
Loggers, Engineers Car	1/Well
Misc. Supplies/Pick-Up	2/Well
Well Completion And Testing	
Completion Unit/Rig	1/Well
Completion Equipment Truck	1/Well
Completion, Crew Pick-Up	12/Well
Completion Pusher	3/Well
Proponent Supervisor	2/Well
Tubing Trucks	1/Well
Service Tools	2/Well
Loggers/Truck	1/Well
Loggers/Car	1/Well
Anchor Installation	1/Well
Frac Unit	1/Well
Sand Storage Bin	1/Well
Blender	1/Well
Chemical Truck	1/Well
Sand Truck	9/Well
Manifold Truck	1/Well

Table E–1 Summary of Vehicle Trips Needed for Construction, Drilling, and Completion of Wells Under the Alternatives

Facility/Activity	Frequency of Trips
Manifold Trailer	1/Well
Instrument Van	2/Well
Misc. Supplies Pick-Up	4/Well
Well Site Facilities Installation	
Roustabout Crew Truck	2/Well
Welder Truck	5/Well
Water Truck	24/Well
Gathering Pipelines Installation	
Haul Truck for Dozer	2/Mile of Flowline
Haul Truck for Ditcher	1/Mile
Haul Truck for Side Boom	4/Mile
Haul Truck for Track Hoe	2/Mile
Crew Pickups	21/Mile
10 Yard Dump Trucks for Padding	117/Mile
Haul Truck – Pipe and Materials	3/Mile For 4-inch Pipe 8/Mile For 20-inch Pipe
Well Operations	
Well Workover	
Service Unit	1/Well
Service Unit Crew Pick-Up	2/Well
Pusher Truck	1/Well
Proponent Supervisor Pick-Up	1/Well
Pumper Pick-up	1/Well/Day
Compressor Site Installation And Operations	
Installation	
Tractor Truck	8/Site
Trailer	4/Site
Cement Truck	4/Site
Gang Truck	30/Site
2 Welding Trucks	30/Site
Pick-Up	100/Site
Operations	
Pick-Up	2/Day
Gang Truck	1/Week
Water Truck	2/Month
Produced Water Collection By Truck	
Water Truck[1]	5/month (Average)[2]

Notes:
1. Use of the water truck would vary by alternative.
2. Water production varies by well display range
Source: Brown 2001a.

E.2.3 Gathering Pipelines

The system of gathering pipelines the companies would construct to each well would depend on the projected production of water and gas. Gas would be transported from the well via a gas-gathering pipeline to a central location (a compressor station), where it would be compressed further for transportation to the sales point. In contrast, the pipeline gathering system for produced water typically would not be justified economically if the anticipated rate of water production were low for a specific well. In these cases, the water would be directed into tanks installed at the well site for temporary storage and subsequently would be trucked off site to an approved disposal facility. Where tanks are not used, the produced water would be transported via a gathering pipeline directly from the well to a central point (not necessarily the same point as the gas), where it would be injected under pressure into deep subsurface formations. All water disposal facilities require approval of COGCC, EPA, or both. Also, BLM has a role in approving water disposal per Onshore Order No. 7.

Gathering pipelines for transporting gas and produced water from the wells would vary in size and material, depending on the volume of gas and water the well is expected to yield. Pipelines with diameters ranging from 3 to 6 inches would be constructed of polyethylene, fiberglass, or steel. Pipelines with diameters of 8 inches or more would be constructed of steel.

Typically, both the gas- and water-gathering pipelines would be located in the same ditch within the pipeline corridor. The companies would construct the pipelines and reclaim the ROWs after a specific sequence of procedures had been completed. These procedures are described below.

E.2.3.1 Pre-Construction Surveys

Design and construction of CBM well pads, roads, and ancillary production facilities begins when the location of each is selected. In the case of federal lands, on-site visits are conducted to first identify locations, routes that, where possible and practical, use existing disturbed areas and roads. Preliminary locations are verified by BLM (and by FS on NFS lands) and, if necessary, the affected landowner if an easement across private lands is necessary. After an agreement is reached for the specific locations, the companies would survey the area for distances and data on terrain. An engineer would then design the road, well pad, or ancillary production facility. Once designed to the required standards, the well pad, road, pipeline, or facility would be staked on the ground to provide the information necessary for construction.

E.2.3.2 Pipeline Construction and Installation

After the pipeline has been approved, the right-of-way (ROW) would be cleared of major obstacles that could impede construction. Brush would be cleared by hand or with a mechanized mower called a brush hog. Trees would be limbed and the brush would be staged alongside the ROW for cleanup after construction is complete. Trees identified for removal would be cut and stacked along the ROW. BLM or FS would sell trees of commercial size for construction that occurs on federal lands. No one would be allowed to remove any of the wood from the ROW unless authorized by the jurisdictional agency.

After clearing is complete, all survey stakes would be reset to their original locations, and a track dozer would be run the length of the ROW to level out sharp changes in elevation. Pipelines generally require a gradually sloping ditch bottom; installation of the pipeline is facilitated if these elevation cuts are excavated early in this process.

With the ROW prepared, excavation of the pipeline trench would begin. Track-mounted backhoes or a wheel trencher would be used to excavate the trench, depending on the terrain that is crossed. Excavated soils would be piled alongside the trench. The depth and width of the trench would be a function of the size and number of pipelines that would be installed. As they lie in the trench (edge to edge), the pipelines must be separated by at least 10 inches and must be at least 6 inches from the wall of the trench. There must be a minimum of 36 inches of cover above the pipeline.

Steel pipelines would be joined by welding and bent as required to fit the contour or route of the trench. Sideboom tractors equipped with bending shoes would be used to bend pipe. The welding equipment is usually mounted on ¾- to 1-ton trucks. As many as five welders could be working on the pipeline simultaneously, depending on the distance involved and on time constraints.

A representative number of welded joints would be checked by radiography to ensure the welds meet standards established by the companies. Company inspectors, along with representatives of the radiographic company, would review and interpret the x-ray films. Every weld is inspected, ensuring that the mechanical integrity of the joint is maintained. The joint is wrapped in a protective tape after it has passed inspection, as is the balance of pipe before it is installed. Often, steel pipe is purchased with an external coating.

Once the pipe is in the trench, the padding is completed by placing soil or sand that is free of rock over and around the pipe to a depth of 6 inches. If sand is needed, it would be obtained off site from a private sand and gravel pit and would be trucked to the trench. Rock-free subsoil excavated from the ditch would be used as padding where possible to minimize the need to import sand. Specially manufactured rock shield also could be used to protect the pipe. With the padding complete, the trench would be backfilled using the material that had been excavated previously.

Fiberglass pipe would be assembled by threading one joint of pipe to the next. The threaded portion of the joint would be coated with a lubricant-sealant material supplied by the pipe manufacturer. The externally threaded joint engages the internally threaded joint, and the installation is made leak-tight through o-rings used on both the front and back of the externally threaded joint. The fiberglass pipeline usually is assembled in the ditch; however, it can be assembled on the surface and then lowered into the ditch. Fiberglass pipe is always installed on a bed of padding material to ensure protection from rocks. Once it is in the ditch, the pipe is covered with the padding to a depth of 6 inches. After the pipe has been padded, the trench is backfilled using the material excavated previously.

Polyethylene pipe would be joined by a process known as heat fusion. In this process, both ends of the pipe are inserted in a special piece of equipment and then heated to a high temperature so the ends of each pipe melt together to form the joint. After the joint is fused, the pipe would be lowered by hand into the ditch. The polyethylene pipe, like the fiberglass pipe, would be installed on a padded surface and then covered with padding before the trench is backfilled.

The excavated material would be backfilled using tractor dozers, track mounted backhoes, or both. Backfilling would begin immediately after the pipe is lowered into the ditch. Heavy equipment would compact the backfill in the trench. Once sufficient compaction has been achieved, the contractor would crown the trench to ensure that enough soil is available to compensate for any subsidence.

E.2.3.3 Pipeline Testing

After the trenches are backfilled, the companies would divide the pipeline into sections and test them for strength and integrity. Typically, the tests involve filling the test section with water and applying pressure for 8 hours. The companies use trucks to haul water to the test section and truck-mounted pumps to transfer the water between the trucks and the pipeline. Test equipment is used to raise the pressure in the test section, maintain the pressure throughout the test, and continuously record the pressure on a chart. A representative of the company or its contractor witnesses each test. The companies would retain the recording charts.

As an alternative, some companies may use air or nitrogen to test the integrity of the pipeline. This procedure is similar to the test that uses water. The test section of pipe would be filled to a prescribed pressure with nitrogen. The nitrogen is vented after the integrity of the pipeline is assured.

If the test detects a leak, the companies would locate, excavate, repair, and rebury the defective segment of the pipeline. The pressure test is then repeated. The process is reiterated until no leaks are detected to ensure the integrity of the segment. Wastewater would be directed to appropriate facilities for disposal.

E.2.3.4 Reclamation

After the pipeline has been successfully tested, efforts to reclaim the ROW would occur as soon as favorable weather and growing conditions occur. The reclamation program would be based on requirements established with FS, BLM, or other landowner. In addition to seeding the ROW, the contractor may run a mechanical chipper to ensure that all brush and tree limbs are chipped and spread. In addition, the contractor would remove all trash and debris, equipment, and surplus materials. Finally, the contractor would restore all roads used for constructing the pipelines to original conditions. When reclamation is complete, the companies would conduct a final joint inspection with the jurisdictional land management agency or individual landowners.

E.2.4 Electric Utilities

Electricity may be used in several aspects of the project. If it is available, the companies may use electricity during well development and to initiate and maintain production. They also may use electric-powered compressors in lieu of gas-fired compressors. Based on the present power demand for existing facilities, the anticipated monthly electricity usage is presented by alternative in Tables 2–3, 2–8, 2–12, 2–16, and 2–20.

Electricity would be routed to wells and compressors along the access roads or additional right of way across open land. Installation and power would be provided by La Plata Electric Association, Inc. Electrical power cables or lines would be installed either underground or overhead adjacent to the road on the side opposite the pipeline ROW or on additional rights of way across open land. The public utility would install power lines as necessary. The junction boxes would be painted an agency-approved color to blend with the surrounding environment after each well begins operation.

Electrical distribution lines would connect wells and compressor facilities with the exiting transmission and distribution system in the Project Area. Installation would follow standard procedures for the electrical utility industry, and reclamation would be similar to the measures used in installing underground pipelines. Installation would occur within a 20-foot wide disturbance ROW; 5 feet would overlap with the adjacent access road. The remaining 15 feet would be new disturbance.

E.2.5 Disposal Wells for Produced Water

Essentially, construction of pads for wells to be used for disposing of produced water would follow the same basic procedures described for the gas wells. The pad would be stripped of vegetation and topsoil.

Although the basic construction procedures would be similar, the pads for gas wells and pads for wells that would dispose of produced water differ in two primary ways. First, the pads for some wells for disposal of produced water could be collocated with compressor units on a compressor station. An access road, pipeline for produced water and, possibly, an electrical distribution line would be constructed to the disposal well. Disturbance from the disposal well would encompass about 1.6 acres. When disposal wells are located on a compressor station, they would disturb 1.6 acres of the 3-acre compressor station. Areas on the pad where heavy equipment would be used would be covered with gravel.

Second, some companies may construct emergency pits that are connected to each disposal well, which would be constructed and designed to store the require volume of water. If a disposal well must be shut down for repairs, the companies would use these pits for short-term storage of produced water that normally would be sent to the disposal well. If the company cannot repair the disposal well before the emergency pit reaches capacity, pumps at the gas wells that are directing produced water to the emergency pit would be shut down until the disposal well is repaired. After the disposal well is repaired, water in the

emergency pit would be pumped to the well for disposal, and regular operations would resume.

Companies that do not use emergency pits would route the water to other disposal wells, truck it to other disposal wells, or shut down production until the disposal well is repaired.

In addition to the well and an emergency pit, if used, features of the typical disposal well would include two 1,000-barrel tanks for storing water, a 90-barrel steel sump for collecting operational wastes, and a pump building. The pump building would contain charge pumps, a water filtering system, and two 200-horsepower, high-pressure triplex injection pumps. The pumps could be electrically driven or fired by natural gas. The two 1,000-barrel holding tanks would be heated during the winter by a 500 Btu per hour heater fired by natural gas. The sump would be pumped out routinely, and the contents would be hauled to an approved disposal site. The pump building and external non-galvanized equipment would be, to the greatest extent practical, painted colors specified by BLM, FS, the state, or landowner, or would be constructed of non-reflective materials. Lights (250 watt) would be installed on poles and directed downward to illuminate key areas.

Construction of a disposal well would be similar to a CBM well. Although the disposal well would be much deeper (5,000 to 9,000 feet deep) than a producing CBM well, the well bore would be cased in a similar manner and cemented to the surface to prevent movement of fluids to other formations. Produced water would be injected down tubing to an interval in the well bore that is isolated from the uphole casing by a packer. The water would pass through perforations into the receiving formation at the specified interval.

All disposal wells must meet strict testing requirements established by government agencies (COGCC and EPA) to ensure that the zone that receives the produced water is not potentially productive for other hydrocarbons and that waters in the zone are of a poorer quality than the water being disposed of. The agencies also require that operators demonstrate that fluids do not migrate among zones. Finally, performance during the life of the well would be continuously monitored by the companies and the agencies.

E.2.6 Gas Compression

The companies would construct the compressor stations using a process similar to the well pads. First, an access road would be constructed from the existing transportation network to the site. Vegetation then would be cleared from the site and the topsoil would be stripped and stockpiled. An area of 3 acres would be graded for each station using standard cut-and-fill techniques and equipment (dozers and graders). The components for the facility then would be installed. Gas pipelines would be built to the site concurrent with construction of the station.

Long-term disturbance for construction and operation of a compressor station for the life of the project would total 3 acres. Two hundred fifty-watt, clear

lamplights would be installed to illuminate each compressor facility. Each light would be mounted on a pole or building and directed downward to illuminated key areas within the facility. At the same time, the lamp would be directed to minimize the amount of light projected outside the facility.

Gas from the compressor stations would be transported to trunk pipelines that are already in place throughout the Project Area. Most of the stations would be constructed at locations that adjoin existing trunk pipelines so that the companies could readily connect them. However, two stations in the southern part of the Project Area would require construction of trunk pipelines to connect the stations to the existing pipelines. Although the specific routes for these pipelines have not been identified, the agencies estimate that about 17 miles of new trunk pipeline would be required, which are included in Alternatives 1 and 2. These pipelines, which would be constructed of steel pipe, would disturb about 82 acres of surface area within a 40-foot-wide ROW. No long-term disturbance is anticipated because all components of the pipelines would be buried and the surface would be revegetated. Alternatives 3, 4, and 5 result in 10 miles of new trunk pipeline, which would result in 48.5 acres of short-term disturbance.

Generally, compressor stations would consist of the compressor engines, two dehydrators, one amine skid, and miscellaneous tanks. These tanks would hold produced water (possibly two 400-barrel tanks), 500 gallons of lube oil for each compressor, 95 barrels of storage for used lube oil until it is hauled away for recycling, 500 gallons of glycol associated with the dehydrators, and 100 gallons of storage for diethanolamine used in the amine process. The compressor engines would be equipped with emission controls.

The layout of compressor stations would vary somewhat by company. The BP America sites would consist of the compressors, two dehydrators, and miscellaneous tanks to store produced water (possibly two tanks of 400 barrels each). The tanks also would hold 500 gallons of lube oil for each compressor, 95 barrels of capacity per site for storing used lube oil until it is hauled away for recycling, and 500 gallons of glycol storage associated with the dehydrators. The tanks also could store 500 gallons of ethylene glycol used in dehydration. The Pure Resource compressors would be located on existing pads, so no new disturbance would be expected. There would likely be one more dehydrator and some additional tank storage for lube oil, used lube oil, produced water, and glycol for the dehydrators.

The compressors would be installed on an as-needed basis. The horsepower operated would grow over time as additional wells are drilled and then decline as the gas reserves deplete. Although the schedule for installing the additional compression units would depend on incremental rates of gas flow, the agencies assumed that new compressors would be deployed in 2003 and 2004. Actual horsepower at each site would depend on the success of the proponent in obtaining pipeline rights of way from owners of private surface and the amount of gas transported to a compression site.

E.2.7 Workforce Requirements

Most of the active workforce for developing the alternatives would be involved in construction. Minimal personnel would be required to operate in the field after access roads, well pads, and compressor stations are constructed; pipelines and utility lines are installed; and wells are completed. The estimated maximum employment requirements for construction, operation, decommissioning, and reclamation of each of the alternatives are discussed in Chapter 3.

E.2.8 Construction Resource Requirements

Construction would require a variety of materials and equipment. The primary materials would be water and gravel. Additionally, small amounts of chemicals would be required. Equipment needed for construction would include heavy machinery (such as bulldozers, graders, track hoes, and front-end loaders) and heavy- and light-duty trucks.

E.2.8.1 Drilling and Completion Phase

E.2.8.1.1 Roads

The rough road constructed for initial access to the well pad also would be used for the drilling phase. The road would be reclaimed if the well is not successfully completed. The access road also would be finished if the well is completed successfully.

Gravel would be required in construction of roads, well pads, and compressor facilities. Gravel would be used to surface all newly constructed roads in the collector and local classes to ensure that the surface is adequate for year-round travel. The estimated volume of gravel needed if surfacing is required on all new roads, well pads, and compressor facilities is summarized for each alternative in Tables 2–5, 2–10, 2–14, 2–18, and 2–22, although gravel requirements for roads varies between the Forest Service and BLM. Approximately 13 inches of gravel would be applied on roads and well pads. The companies would purchase gravel from local commercial sources. Dust would be controlled by spraying water on the road, as needed, during construction.

E.2.8.1.2 Wells

Drilling, Casing, and Logging

The drilling phase would begin with setting four tie-down anchors and digging a rectangular pit, called a cellar, where the hole would be drilled. The tie-down anchors would be used to connect guy wires to the derrick tower. The cellar would provide space for the casing head spools and blowout preventers that would be installed under the rig.

After the tie-downs are installed and the cellar has been constructed, the drill rig would be moved onto the pad, and trucks would transport about 32 loads of various components to the site. Individual components consist of draw works; the power supply; the mast; mud tanks; walkways; guardrails; and auxiliary

equipment to supply electricity, compressed air, and water. Two 500-horsepower diesel-powered pumps (mud pumps) would be brought in to circulate drilling fluids. In some instances, wells may be drilled with compressed air as the circulating medium, and as many as four portable air compressors and two air boosters may be transported to the well site. Storage racks, bins, and office trailers for the tool-pusher and the workforce would be moved to the site. Drill pipe, drill bits, mud components, wire rope, and other supplies also would be trucked to the well pad. This additional equipment would be on location only until the drilling phase is completed.

The drill rig consists of four main systems: power, hoisting, rotating, and circulation. The power system uses diesel engines to provide power for the other systems to operate. The hoisting system includes the draw works (sometimes called the hoist), a mast or derrick, the crown block, the traveling block, and wire rope. The hoist is used to raise and lower the drill pipe and bit. The rotating system consists of the swivel, a four- or six-sided pipe called the Kelly, the rotary table, the drill pipe, drill collars, and the bit. The circulation system consists of a large number of mechanical components to circulate the drilling fluid.

The drilling fluid, often called mud, is a mixture of water, bentonite, caustic soda, barite, and polymers. Water is the fluid used to mix the other constituents to make the mud. Approximately 1,500 to 3,000 barrels of water are needed during drilling to yield the amount of drilling mud necessary for a CBM well.

Drilling mud serves a variety of functions. Mud is used to raise the cuttings made by the bit and lift them to the surface for disposal. Equally important, mud helps keep underground pressures in check. The heavier or denser the mud, the more hydrostatic pressure it exerts.

Bentonite is a naturally occurring clay. About 100 100-pound sacks would be mixed with water to create the drilling fluid. Any bentonite that has not been mixed would remain in the sacks and would be transported to another drilling location for eventual use.

Caustic soda is used to activate the bentonite and raise the pH of the drilling fluid. The amount of caustic soda in the drilling fluid is 0.06 percent to 0.133 percent by weight. During drilling operations, five or six 50-pound sacks would be on location at any time. Any caustic soda that was not used during drilling would remain in the sacks and would be transported to another drilling location for eventual use.

Barite (an inert mineral) is used to increase the weight of the drilling fluid. It has a specific gravity of 4.2; thus, it is 4.2 times heavier than water. It composes less than 22 percent by weight of the drilling fluid. Typically, 400 100-pound sacks would be at the location of the well during drilling. Any barite that was not used during drilling would remain in the sacks and would be transported to another drilling location.

Polymer additives are used to increase viscosity (to keep the other materials in suspension) and control losses of fluid. They also remove small drill cuttings and help stabilize the wall of the well bore before the steel casing is installed. The

polymers are biodegradable. They account for less than 0.10 percent by weight of the drilling fluid. They are stored in 5-gallon buckets, and any unused polymer would be transported to the next drilling location.

The system the companies would use to circulate the drilling fluid involves a 300-barrel reserve pit. The system is designed to recirculate the drilling fluids through portable steel mud tanks. Some of the drilling fluid and mud could be transported to another location for reuse when drilling operations are complete. The remaining drilling mud and drill cuttings would be contained in the reserve pit. The pit would be backfilled when drilling has concluded, after all free liquids have been removed or evaporated.

Drilling involves four primary steps. They are: (1) keeping a sharp bit on the bottom to drill as efficiently as possible, (2) adding a new string of pipe as the hole deepens, (3) tripping the drill string out of the hole to install a new bit and running it back to the bottom, and (4) installing casing and cementing in the hole. Typically, a hole 12¼ inches in diameter is drilled to a depth of 350 to 500 feet for CBM wells in the Project Area. This hole is then cased with 8⅝-inch steel casing that is cemented in place to the surface. A 7⅞-inch hole is subsequently drilled from the bottom of the steel casing (350 to 500 feet) to 4,000 feet, depending on the depth to the coals.

CBM wells in the eastern portion of the Project Area would be the deepest and could be up to 8,000 feet below the surface. A 12¼-inch diameter steel casing would be set from ground surface to a depth of 350 feet to 500 feet. Then, an intermediate string of casing, about 7 inches in diameter, would be set to a depth of 4,000 feet and would be cemented in place from the surface to cover the Fruitland formation. Finally, a production string would be set from surface to total depth using 5½-inch casing and cemented into place.

Individual casing strings would be cemented to contain produced fluids and prevent them from migrating up the hole. The cement is poured after the steel casing is lowered into the hole using specially designed cement. The cement is mixed and pumped down the inside of the casing behind a special plug that wipes the casing and pushes the drilling mud ahead of the cement. When the cement reaches bottom, the plug shears under pressure and allows the cement to be circulated to the surface between the well bore and the outside of the casing. After the cement has been pumped, a second (top) plug is pumped to the bottom of the well bore to remove residual cement from the walls of the casing and ensure that drilling fluids do not contaminate the integrity of the cement. When it is completed, the entire well bore is cased with steel pipe and cemented into place.

The eastern portion of the Project Area is characterized by rough topography, and alternative-drilling measures may be needed to reach the target formations. Alternative drilling measures include, but are not limited to, directional drilling. This method allows the operator to reach a target formation that lies at depth within a window that is restricted by topography from a surface location with flatter topography. Directional drilling uses motors on the bottom of the drill pipe to turn the well bore in the desired direction. Deviated well bores cannot exceed 20 degrees from vertical; otherwise, the companies would not be able to produce

the well with the necessary down-hole equipment. Directionally drilled wells are then cased and cemented in the same manner as conventional CBM wells.

Before the casing is placed, the formations within the well bore would be evaluated with sensors conveyed by wireline from the bottom of the surface casing to its total depth below the surface. This evaluation, called logging, enables the company to measure the depth and thickness of the prospective formations.

Well logging uses a truck-mounted laboratory and devices called logging tools that are lowered into the well on a wireline. The logging tools are capable of collecting certain measurements of the rock formations they pass. The tools are lowered to the bottom of the hole and then are reeled up slowly. As the logging tool is retrieved, electrical signals are transmitted through the cable to the surface, where they are recorded on film or digitally stored in a computer. The data are used to create a log that shows the measurements recorded at all points throughout the depths tested. These measurements are used to analyze the various properties of the formations, such as porosity, fluid saturation, and lithology (mineral identification and structure of the rock). After this logging is complete, the company would decide to complete the well or to plug and abandon it. If the company decides to abandon the well, abandonment would meet the applicable requirements (federal or state).

The companies propose to use three to four drilling rigs continuously during the year to complete the number of well windows in the western portion of the Project Area, regardless of the alternative selected. The companies would use four rigs on the eastern portion, limited to seasonal restrictions, regardless of alternative. Drilling each well would likely involve about 6 to 12 days and an estimated six to 19 workers. Vehicular traffic for drilling, defined as the frequency of round trips per well or per day, is summarized in Table E–1.

Well Completion and Testing

After a well is drilled, the companies would initiate a completion and testing program to stimulate and evaluate the characteristics of production for both water and gas. A mobile completion rig, which is similar to the drill rig, is the primary equipment used for the well completion program. The program, which would last 7 to 14 days, would include perforating the well's steel casing, hydraulically fracturing the producing formation, and installing production pipe, known as tubing. The tubing would be connected to a series of valves and fittings (a "Christmas tree") installed on the wellhead.

The companies perforate the casing and cement at the target formation to create holes into the production zone. The pipe must be perforated for the gas to flow into the well bore. The most common method the companies employ to perforate the casing uses shaped-charge explosives.

Hydraulic fracturing stimulates production by increasing the permeability of the formation. In hydraulic fracturing, water is pumped under extremely high pressure downward through the casing or tubing and out through the perforations in the casing. The pressurized fluid enters the productive Fruitland formation and divides or fractures it. The fluid carries grains of sand, aluminum pellets, glass

beads, or similar materials in suspension into the fractures. These materials are called propants. The fracturing fluid returns to the well when the pressure is released at the surface. The fractures then constrict on the propants, leaving channels that enable the gas to flow into the well. Hydraulic fracturing is limited to daylight hours to facilitate the activity and ensure the safety of employees.

Cavitation is another completion technique used to optimize production from a natural gas well. It involves pumping water and foam (composed mainly of biodegradable surfactant) down the well bore into the open-hole portion, where the coal interval lies. The open hole is the portion of a well bore that is not cased with steel pipe. Cavitation may be used in lieu of fracturing, depending on the type of coals in a well bore. Some coals are more receptive to cavitation than to fracturing.

When cavitation is used, water and foam are pumped under pressure into the well bore and isolated into the productive formation. The water and foam break down the coals, creating a cavity and allowing gas to flow more freely into in this portion of the well bore. The process involves repeated steps of pumping water and foam, allowing them to flow to the surface where the pressure is released, and flaring the gas into a pit. Large volumes of coal fines, water, and surfactant also come to the surface, but they are contained in the pit. Flaring the gas is required for safety. When the gas initially comes to the surface during flowback, an instantaneous, but short, burst of noise occurs. This process, which is limited to daylight hours, is repeated several dozen times over the 2-week period when cavitation is conducted. Any residual wastewater generated by the process is contained in a pit and reused for the next location.

It is anticipated, based on industry response, that 100 percent of the CBM wells would be fractured in the eastern side of the Project Area. On the western side, Pure Resources expects to use both fracturing (75 percent) and cavitation (25 percent) to stimulate wells. J.M. Huber would use fracturing to stimulate 100 percent of wells. BP America would use both fracturing (85 percent) and cavitation (15 percent) to stimulate wells. Even though the produced water and gas can flow into the casing after it is perforated, a small-diameter pipe, called tubing, is inserted in the well to serve as a means for the produced water to be brought to the surface. The tubing is run from the Christmas tree into the well to a point below the perforated interval. Fluids that enter the well are then pumped up the tubing to the surface. Production must pass through and so can be controlled by opening and closing valves on the Christmas tree.

Venting gas at well sites during completion and connection of the well to pipelines would be minimal. Venting occurs when the well is flowed back to the surface after hydraulic fracturing to purge the formation of the water that is used in the process. Slight amounts of gas are produced in flowing back the well after fracturing. The gas and water flow to four to six temporary 400-barrel storage tanks. Gas that enters the tanks with the water is separated and vented to the atmosphere. Venting would occur only when water is recovered and would last for a period that could vary from a matter of days to up to a month. It is estimated the amount of gas vented during hydraulic fracturing would be about 500 thousand cubic feet (mcf) per well. The noise associated with venting during completion is minimal because the well bore is cased. After the water used in

fracturing is recovered, the well would be tied into the gas- and water-gathering system. None of the companies proposes to flare wells after fractures have been stimulated.

In contrast to fracturing, completion using cavitation involves flaring instead of venting. During cavitation, gas is flowed back to the surface at a high volume for 10 to 30 seconds and then subsides. The gas is flared for safety because of the amount of gas that could be brought to the surface. Although flowback during cavitation would be limited to daylight hours, the pilot light on the flare may be lit for the duration of cavitation, even at night. Water would be held in the reserve pit.

Unsuccessful Wells

Unsuccessful wells would be reclaimed as described in this section.

E.2.8.2 Production and Maintenance Phase

E.2.8.2.1 Access Roads

Routine maintenance of access roads in the Project Area would occur year-round or as ground and site conditions permit. Summer (late spring to early fall) maintenance would involve the addition of gravel, blading consistent with "traveled road maintenance operations," or both. Winter (late fall to early spring) maintenance would include plowing snow from access roads and some summer-like maintenance, when necessary and permitted by weather conditions. The companies would not routinely employ dust abatement procedures on the roads within the Project Area during production and maintenance.

The counties would continue to maintain existing county roads, and the companies would maintain all other roads constructed under any of the alternatives.

When the project is complete, all roads constructed specifically for the project would be removed and reclaimed, unless the landowner specifically requests otherwise. A landowner who decides to keep a road would accept responsibility for maintaining it when the companies abandon it. The counties would continue to maintain existing county roads and any roads covered by maintenance agreements with BLM and FS.

E.2.8.2.2 Wells

Production

Surface production facilities installed at the well site would include the Christmas tree (mentioned previously), a pumping device (such as a beam or progressive cavity pump), separation and dehydration facilities, gas metering facilities, tanks for produced water, and a connection to the gas- and produced water-gathering systems. The total area that would be used for long-term production operations at a single well pad would occupy 1 acre or less. All areas that are not needed for production would be covered with the topsoil that had been stored previously. These areas would be seeded in the fall.

When necessary, a pump would be used to lift produced water from the production zone, allowing the gas to flow by reducing the hydrostatic pressure on the coals. A 40- to 48-horsepower reciprocating engine, fueled by propane, produced natural gas, or an electric motor (15 horsepower, if adequate electrical power is available), would power the pump. Typically, a pump jack or beam unit is used to actuate the downhole pump.

Another mechanism to lift water from the production zone is a progressive cavity pump or "PC pump." The PC pump uses a similar 40- to 48-horsepower gas-fired engine, but the engine acts as the prime mover for lower-profile hydraulic equipment located on the wellhead. The hydraulic equipment turns the rod string at the surface that is connected to the PC pump, located at formation depth inside the well. Selection of a PC pump or a beam unit actuated downhole pump would depend on a variety of factors for each well, including individual production characteristics and economics.

Produced gas would be separated from produced water by a two-phase separator located at the surface of each well site. The gas stream would then be filtered, measured, and introduced into the gas-gathering pipeline system that is served by a compressor station. Produced water either would be routed to a storage tank or held in a gathering pipeline system for disposal. The remaining on-site facilities on the surface would be an outhouse-sized meter house to measure the gas. Some companies would use automation to remotely monitor a well's operational characteristics. Well pads configured for remote monitoring also would include an antenna with a solar panel mounted on a 15-foot-tall pole to send data from the well to a central location.

Long-term production trends are difficult to estimate for every CBM well. Generally, the rate of CBM production should increase during the first few years and then gradually decline (Brown 1991). In fact, the trend explains in part why the Proposed Action was developed. The new wells should offset the decline that existing wells are already experiencing in certain areas. The rate of water production should decrease rapidly over the first few years and then stabilize at relatively low levels for the rest of the life of a well (Clark and Hemler 1988, Decker et al. 1988).

Based on its history of production, BP America estimates that artificial lift equipment would be installed on 50 percent of its wells at any time; this equipment could include a beam unit that uses a gas-fired engine or a PC pump powered by a gas-fired engine. Huber estimates that 100 percent of its wells would require a similar artificial lift using a pump jack with a gas-fired engine. Pure Resources estimates that 20 percent of its wells would need artificial lift of the type described above. The operators in the eastern portion of the Project Area estimate that 50 percent of the wells would require artificial lift.

E.2.8.2.3 Routine Maintenance

Company personnel or pumpers would, as part of standard operating procedures, visit each producing well daily to ensure that equipment is functioning properly. Some companies may supplement these efforts with a central, off-site, computer-based automation system, which would allow them to monitor various

operational conditions at each well (such as rates of gas and water production, pipeline pressure, and separator pressure) to evaluate whether abnormal conditions exist. The automation equipment at the well site would be powered by solar panels if electricity from a power grid is not feasible. In this case, data on the operational conditions of the well site would be transmitted the company's offices. Personnel would be dispatched immediately if a problem is identified. Furthermore, an automatic callout system would be in place to immediately contact personnel when the equipment at the operating center office is not monitored continuously. The combined efforts of the on-site visits and the automation system allow for operational conditions to be monitored continuously and for expeditious responses to potential problems.

E.2.8.2.4 Workovers

Wells may periodically require a workover. A workover uses a unit, similar to a completion rig, to ensure the well is maintained in good condition and that it is capable of delivering gas produced from the formation efficiently. Workovers can include repairs to the well bore equipment (casing, tubing, rods, or pump), the wellhead, or the production formation itself. These workovers may require venting to relieve pressure, which would involve brief periods of noise. These repairs would occur during daylight only and usually would be completed in several days. However, several weeks may be required to finish a workover in some limited situations. The frequency for this type of work cannot be accurately projected because workovers vary well by well, depending on circumstances. However, the agencies assumed one 4 -day workover per year per well for this NEPA analysis.

E.2.8.2.5 Pipelines

Pipelines for gathering gas and produced water would be routinely inspected concurrent with daily inspections of facilities. Procedures would be incorporated with the daily inspection of meters at the well sites. The wells would be shut in if pressure losses are detected until the problem is isolated and rectified.

E.2.8.2.6 Electric Utilities

Electric utilities would be routinely inspected and maintained by La Plata Electric Association, Inc.

E.2.8.2.7 Disposal of Produced Water

Produced water is a distinctive bicarbonate-type connate water (Rice et al. 1988). Water produced from CBM wells is a sodium bicarbonate type with concentrations of total dissolved solids that are much lower than most oil field brines. However, it too is sometimes referred to as brine.

Production of water from wells within the Project Area varies considerably. Currently, wells produce four barrels/day in the eastern portion of the Project Area. The total daily water production for the proposed wells located in the eastern portion of the Project Area would thus average about 75 barrels of water per day per well; however, it may likely be less based on current production. The rate of production would vary from 100 to 200 barrels of water per day per well in the western portion of the Project Area. BP America anticipates the average

water production from wells in the western portion of the Project Area would be 100 barrels of water per day per well. Pure Resources anticipates that the rate of production would average 135 barrels of water per day per well. J.M. Huber estimates that the rate of production would average 200 barrels per day per well.

The companies would dispose of produced water using three primary methods. First, they would transport produced water to approved disposal wells by truck or pipeline; second, they could hold water in existing evaporation pits located south of the Project Area; or, third, could surface-discharge the water into drainages. When disposal wells are used, the water would be injected into deep geologic formations, such as the Mesaverde, Dakota, Burro Canyon, Entrada, or other deeper formation. Each method is discussed below.

Water would be processed using a standard series of steps at the disposal well. First, water is received at the disposal well through pipelines or by truck and initially is stored in holding tanks. The two charge pumps would move water from the holding tanks through a cartridge filter to the triplex pumps. The triplex pumps generate the pressure needed to inject the water down the disposal well and into the formation. The facilities would operate 24 hours a day.

The companies located in the eastern portion of the Project Area in Archuleta County anticipate a combination of hauling by and surface disposal. As many as four disposal sites may be installed and operated. Because of geologic differences in the coal seams, wells in the eastern portion of the Project Area would probably produce less water per well than in the western portion. Consequently, the new water disposal sites in the eastern section of the Project Area may be smaller than are in place or proposed in the western portion. The sites would consist of buildings to house the electrical or gas-fired pumps and any electrical controls. Capacity of the storage tanks would range from 1,000 to 2,000 barrels.

As mentioned earlier, some of the companies are evaluating surface discharge of produced water. If this option is pursued, certain requirements must be met and a permit must be issued by the Colorado Department of Public Health and Environment before any discharge could take place. The quality of produced water when compared with effluent standards and requirements would determine whether surface discharge would be allowed. Treatment of the effluent would likely be necessary to meet these standards. Treatment options could include reverse osmosis or ion exchange technologies. The Southern Ute Indian Tribe—because it is near the Project Area — and EPA also would provide input to the permitting process.

At present, BP America has filed a permit application with the State of Colorado for surface discharge. The location of the discharge would be near the northern portion of Township 35 North, Range 7 West. . The companies also are considering surface discharge in the eastern half of the Project Area. However, because neither the treatment requirements nor the cost for treatment facilities is known, surface discharge of produced water is considered speculative. Additional analysis and permitting would be required before any surface discharge could occur.

E.2.8.2.8 Compression

The gas under wellhead pressure would move through the pipelines to the compressor stations. Unfortunately, the natural wellhead pressure is inadequate to force the gas to flow into the pipelines that carry the commodity to market. Furthermore, the gas usually does not meet specifications for commercial quality and therefore must be treated to remove entrained water, dust, carbon dioxide (CO_2), and other impurities. The following discussion summarizes the various components and activities that could occur at compressor stations within the Project Area.

The main function of compression facilities is to increase the pressure of the gas to match the level in the downstream pipelines that provide market access. Pressure is typically increased using natural gas-fired engines or electric motors that drive reciprocating-type piston compressors, screw compressors, or centrifugal compressors.

In the dehydration process, water-saturated gas enters the bottom of the dehydrator unit and travels upward counter-currently to a liquid glycol stream that moves downward. As the glycol flows downward, it absorbs water from the gas as it moves in the opposite direction. This process is called dehydration because water is removed from the gas stream. The dehydrated gas leaves the top of the unit when the process is complete.

The water-rich liquid glycol leaves the bottom of the absorber and it piped to the re-boiler system, where it is heated and the water is vaporized and separated from the glycol until the desired concentration of lean glycol is produced. The water-lean liquid glycol is then recirculated to the dehydration system in a continuous process. Glycol is fully contained in a closed vessel to ensure no net loss.

A common process for treating gas uses a chemical solution called amine to remove CO_2. Various compositions of amine solution can be used, but diethanolimine (DEA) is the most common. Amine systems consist of two distinct phases: treatment and regeneration. During treatment, the produced gas stream and liquid amine (DEA) are brought together counter-currently in the amine contactor. The CO_2 in the produced gas is absorbed into the amine solution as a result of chemical reactions between the produced gas stream and amine. The amine solution that contains the CO_2 then passes to the amine regenerator to remove CO_2. The amine solution is contained in the closed vessel.

The chemical reaction that took place in the contactor is reversed by adding heat during regeneration of the amine. The vaporized CO_2 is released and vented. The amine, which is now regenerated, is recirculated to the treating section in a continuous process

E.2.8.3 Decommissioning and Reclamation

The alternatives assume that each well would produce during its approximate 25- to 30-year economic lifetime. Reclamation of dry holes would follow the procedures described below, except that reclamation would begin as soon as possible after the companies conclude that the well would not continue to produce economically. The following briefly describes the procedures that would

be used to reclaim the disturbance to as near as possible to pre-developed conditions.

E.2.8.3.1 Access Roads

Access roads would be reclaimed by plowing and seeding, unless the landowner or land manager wishes to make use of any roads and accepts responsibility though execution of release for future road maintenance. Roads that are not needed for further use would be blocked, re-contoured, reclaimed, and vegetated consistent with the requirement of the federal land managers (according to Onshore Oil and Gas Order No. 1, Approval of Operations). On private lands, the companies would execute a release of the road to the landowner or reclaim it according to the terms of surface use agreements in effect at the time.

Disturbed areas would be backfilled as needed and graded to the desired configuration. Erosion-control features would be installed to stabilize the surface, if necessary. Gravel surfaces would be removed.

All road disturbances would be revegetated with a seed mixture authorized by the agency or landowner. The seed mixture would be planted in the amounts specified in pounds of pure live seed per acre. All seed would be certified as weed free. Seed would be tested in accordance with state laws and within 12 months before it is purchased. Commercial seed would be either certified or registered. Seeding and planting would be repeated until satisfactory revegetation is achieved.

E.2.8.3.2 Wells

All surface facilities would be removed. Depleted production wellbores would be plugged and abandoned in accordance with Onshore Oil and Gas Order 2 and COGCC rules. After the well is conditioned as a static column, it would be decommissioned by inserting redundant plugs (a slurry of cement and water) at strategic locations in the well bore. These plugs would be installed based on the configuration of each well and would be located to prevent migration of fluids through the well bore or any uncemented paths. A mixture of bentonite and water would be poured between the cement plugs. At a minimum, the abandonment process would consist of the following steps, subject to the requirements of the surface owner:

- Surface equipment and facilities would be disassembled and removed.
- The full well bore would be plugged and sealed with cement, or plugs would be inserted strategically within the casing, which was cemented in the annulus before the well was completed.
- Gravel surfaces at the well pad would be removed.
- Disturbed areas would be backfilled and graded to the desired configuration.
- Erosion-control features to stabilize the surface would be installed as necessary.

- The surface would be tilled and prepared for seeding.
- Seed, mulch, and other materials would be added as necessary to promote reestablishment of vegetation.

E.2.8.3.3 Gas and Produced Water Gathering Pipelines

The procedures for decommissioning the reclaiming pipelines vary depending on whether the pipeline is underground. Underground pipelines would be cleaned, disconnected, and then abandoned in place to avoid unnecessary disturbance of the land surface.

E.2.8.3.4 Electric Utilities

As with pipelines, the procedures used to decommission and reclaim electrical power lines would vary depending on whether the power lines are under ground or above ground. Underground power lines would be disconnected and abandoned in place to avoid unnecessary disturbance to the surface. All aboveground facilities related to the underground power lines would be removed, and any disturbance associated with these facilities would be reclaimed. Aboveground electrical power lines would be disconnected and the power poles and lines would be removed.

E.2.8.3.5 Disposal Wells for Produced Water

Disposal wells would be abandoned and reclaimed in the same manner as CBM production wells.

E.2.8.3.6 Compression Facilities

Underground pipelines that lead to and from the compressors would be cleaned, disconnected, plugged, and abandoned in place. All aboveground facilities and equipment, including the compressors, amine and dehydration units, and buildings, would be disassembled and removed from the site. The locations of the compressor stations would be recontoured as close as possible to the original conditions. Revegetation measures would then be implemented using the reclamation methods described in this section.

Appendix F

Best Management Practices — Construction Site Stormwater Runoff Control

Appendix F — Best Management Practices – Construction Site Stormwater Runoff Control

F.1 Runoff Control

F.1.1 Minimize clearing

Existing cover will be removed only where necessary for the operation of equipment. In general, vegetation will be cut off near ground level, leaving the root system intact. Cuttings may be stacked into a brush dam, distributed along the contour across reclaimed areas during reclamation, or disposed of as directed by the landowner or agency representative.

- Land grading
  - To minimize disturbance associated with installation of the facility, level and gently sloping terrain outside the Project Area will not be graded, except where reasonable for stability of construction equipment and fire safety.
  - Grading outside the Project Area will be done only when necessary for the safe operation of equipment and for fire protection.
- Permanent diversions
  - Where conditions warrant, erosion control structures such as berms, water bars, diversion or collection channels, terraces, or culverts will be constructed to divert water away from the Project Area and to reduce soil erosion along and adjoining areas disturbed during construction.
- Preserving natural vegetation
  - Trees and large shrubs that are not cleared from the site will be protected from damage during construction by avoiding them with equipment. For example, bulldozers will maintain the blades in a raised position except for areas designated for clearing or to smooth out hard breaks in relief.
  - Trees will be cut or trimmed only to facilitate clearing, grading, and safe installation.
  - Trees that must be removed will be cut. Trees outside the area of disturbance will not be cut, but only overhanging limbs will be removed by cutting, with the tree to remain.

- The bulldozers will maintain the blade in a raised position in these sensitive visual resource areas, where practical.

➢ Construction entrances

- To prevent tracking or sediment onto public roads, the proposed facilities shall have, at a minimum, compacted ingress and egress areas adjacent to public roads. Other means such as gravel, scoria, or cattle guards may be used if appropriate.

➢ Stabilize drainage ways

- For construction sites in drainage locations serving five or less acres, silt fences, straw bale dikes, water bars, or equivalent sediment controls are recommended for all side slope and downslope boundaries for the construction area, or a detention basin that provides storage for runoff from a 10-year, 24-hour storm event.

➢ Check dams

➢ Filter berms

- Silt barriers (brush dams, rock filter dikes, silt fences, hay bales, or water bars) will be installed as needed on downgradient portions of the Project Area.

➢ Grass-lined channels

➢ Riprap

F.2 Erosion Control

Erosion control will be accomplished through a combination of construction techniques, vegetation, and structural features.

F.2.1 Stabilize exposed soils

➢ Chemical stabilization

➢ Mulching

- In general, the applicable portions of the Project Area will not be mulched during reclamation and revegetation. Mulch will be applied only at the request of the jurisdictional authority in areas where the cut vegetation and rocks are not redistributed over the disturbed area. (The cut vegetation and rocks will act as mulch in the areas where they are applied.) Where straw or hay mulch is requested, the mulch will be applied and crimped into the soil.

- Permanent seeding
  - Disturbed areas will be seeded using seed mixes appropriate to the location. Local soil conservation authorities with the U.S. Natural Resources Conservation Service, surface owners, or reclamation contractors familiar with the area may be consulted regarding the correct seed mix to be used.
  - On terrain where drill seeding is appropriate, seed may be planted using a drill equipped with a depth regulator to ensure proper depth of planting. The seed mix will be evenly and uniformly planted over the disturbed area. Drilling will be used where topography and conditions of soil allow operation of equipment to meet the seeding requirements of the species being planted.
  - Broadcast seeding will occur on steep terrain and on areas such as where the cut vegetation and rocks were redistributed over the right-of-way.
  - Seeding will be done when seasonal or weather conditions are most favorable according to schedules identified by the jurisdictional authority, reclamation contractor, or landowner. Whenever possible, seeding will be timed to take advantage of moisture, such as early spring or late fall to benefit from winter precipitation.
  - Seed mixes will be planted in the amount specified in pounds or pure live seed/acre, where necessary, there will be no primary or secondary noxious weeds in the seed mix.
- Sodding
- Soil roughening

F.2.2 Protect steep slopes

In areas of steep slopes that are not annually cultivated, water bars or runoff diversions will be installed as indicated in Table F–1. The water bars will begin and end in undisturbed ground at a 2 percent slope.

Table F–1 Spacing for Erosion Control Structures

Slope (percent)	Diversion Spacing (feet)
5 to 15	300
16 to 30	200
> 30	100

- Geotextiles
- Gradient terraces

- Soil retention
- Temporary slope drain

F.2.3 Protect waterways

Where appropriate, water bars or sediment filters, such as staked straw bales or silt fence, will be constructed adjacent to the crossings to reduce potential sedimentation in streams or wetlands. Trenching will cross dry streams. Small flowing streams will be crossed by fluming or trenching with a downstream silt barrier to reduce downstream sedimentation.

- Temporary stream crossings
- Vegetated buffer

F.2.4 Phased Construction

- Construction sequencing
- Dust control

F.3 Sediment Control

F.3.1 Install perimeter controls

Silt barriers (brush dams, rock filter dikes, silt fences, hay bales, or water bars) will be installed as needed on downgradient portions of the Project Area.

- Temporary diversion dikes
- Wind fences and sand fences
- Brush barrier
- Silt fence

F.3.2 Install sediment trapping devices

The construction sites may use vegetative filters, brush dams, rock filter dikes, silt fences, straw bale dikes, water bars, or equivalent sediment controls installed to protect downslope surface waters, wetlands, and roads from sediment flow caused by runoff from a storm event.

- Sediment basins and rock dams
- Sediment filters and sediment chambers
- Sediment trap

F.3.3 Inlet protection

- Storm drain inlet protection
  - Inlet protection may include inlet aprons and rock armoring around the culvert perimeter while below-grade inlet sumps may be installed to enhance deposition.

F.4 Good Housekeeping

F.4.1 Other wastes

- General construction site waste management
  - All waste from materials imported to the construction site are to be removed for disposal or recycling to an appropriate licensed disposal or recycling facility, including sanitary sewage facilities (typically portable). No wastes or important materials shall be buried, dumped, or discharged to waters of the state.

- Spill prevention and control plan
  - Hazardous materials and petroleum products to be used in construction of the facility are limited to fuel and lubricants for construction equipment and vehicles; small quantities of paints and solvents; water, or gel-based frac fluids (surfactant, friction reducer, acid, potassium chloride) using during completion; produced water; and crude oil and condensate. Material Safety Data Sheets (MSDSs) for materials to be used are found in the Spill Prevention Control and Countermeasures (SPCC) Plan that will be available at the site or the closest regional office.

- Vehicle maintenance and washing areas
  - Vehicles will be refueled and lubricated a minimum of 100 feet back from flowing streams and wetlands. Spills will be promptly cleaned up and contaminated materials hauled off-site and disposed of or recycled properly. Quantities of materials no site will be limited to "as-needed" for the immediate operations under way.

F.4.2 Education and awareness

- Contractor certification and inspector training
- Construction reviewer
- BMP inspection and maintenance

- Inspections will be conducted at least every 14 calendar days and within 24 hours or any precipitation event exceeding 1.0 inch during construction and before reclamation begins.

- Inspections will be documented and these records kept on file for 3 years after reclamation.

➢ Model ordinances

F.5 Bibliography

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Appendix G
Noxious Weed Species

Appendix G — Noxious Weed Species

Table G–1 Noxious Weed Lists (State of Colorado, La Plata County, and Archuleta County)

Common Name	Scientific Name	Colorado State List[1]	La Plata County List	Archuleta County List
Absinth wormwood	*Artemisia absinthium*	A, C		
African rue	*Peganum harmala*	A, C		
Black henbane	*Hyoscyamus niger*	A		
Black nightshade	*Solanum nigrum*	A		
Blue flax	*Linum perenne*	n/a	Potential invader	
Blue mustard	*Chorispora tenella*	A		
Bouncingbet	*Saponaria officinalis*	A, C		
Bull thistle	*Cirsium vulgare*	A		Y
Camelthorn	*Alhagi pseudalhagi*	A, C		
Chamomile	*Matricaria perforata*	n/a	Recommended control	
Canada thistle	*Cirsium arvense*	A, B	Recommended control	Y
Chicory	*Cichorium intybus*	A		
Chinese clematis	*Clematis orientalis*	A		
Coast tarweed	*Madia sativa*	A, C		
Common burdock	*Arctium minus*	A		
Common crupina	*Crupina vulgaris*	A, C		
Common groundsel	*Senecio vulgaris*	A		
Common mullein	*Verbascum thapsus*	A		
Common St. Johnswort	*Hypericum perforatum*	A		
Common tansy	*Tanacetum vulgare*	A		
Common teasel	*Dipsacus fullonum*	A, C		
Cypress spurge	*Euphorbia cyparissias*	A, C		

Table G–1 Noxious Weed Lists (State of Colorado, La Plata County, and Archuleta County)

Common Name	Scientific Name	Colorado State List[1]	La Plata County List	Archuleta County List
Dalmatian toadflax, broad-leaved	*Linaria dalmatica*	A, B	Mandatory control	Y
Dalmation toadflax, narrow-leaved	*Linaria genistifolia*	A, B	Mandatory control	Y
Dame's rocket	*Hesperis matronalis*	A	Potential invader	
Diffuse knapweed	*Centaurea diffusa*	A, B	Mandatory control, Potential invader	Y
Downy brome (cheat grass)	*Bromus tectorum*	A		
Dyer's woad	*Isatis tinctoria*	A, C		
Eurasian water milfoil	*Myriophyllum spicatum*	A, C		
Field bindweed	*Convolvulus arvensis*	A, B	Recommended control	
Flixweed	*Descurainia sophia*	A		
Giant salvinia	*Salvinia molesta*	A, C		
Green foxtail	*Setaria viridis*	A		
Hairy nightshade	*Solanum sarrachoides*	A		
Halogeton	*Halogeton glomeratus*	A		
Hoary cress	*Cardaria draba*	A, B	Recommended control	Y
Houndstongue	*Cynoglossum officinale*	A, B	Recommended control	Y
Hydrilla	*Hydrilla hydrilla*	A, C		
Johnsongrass	*Sorghum halepense*	A		
Jointed goatgrass	*Aegilops cylindrica*	A		
Kochia	*Kochia scoparia*	A		
Leafy spurge	*Euphorbia esula*	A, B	Mandatory control	Y
Mayweed chamomile	*Anthemis cotula*	A		
Meadow knapweed	*Centaurea pratensis*	A, C		
Mediterranean sage	*Salvia aethiopis*	A, C		
Medusahead rye	*Taeniatherum caput-medusae*	A, C		
Moth mullein	*Verbascum blattaria*	A, C		
Musk thistle	*Carduus nutans*	A, B	Recommended control	Y
Myrtle spurge	*Euphorbia myrsinites*	A, C		

Table G–1 Noxious Weed Lists (State of Colorado, La Plata County, and Archuleta County)

Common Name	Scientific Name	Colorado State List[1]	La Plata County List	Archuleta County List
Orange hawkweed	*Hieracium aurantiacum*	A, C	Potential invader	
Oxeye daisy	*Chrysanthemum leucanthemum*	A	Recommended control	
Perennial pepperweed	*Lepidium latifolium*	A		Y
Perennial sowthistle	*Sonchus arvensis*	A		
Plumeless thistle	*Carduus acanthoides*	A		Y[2]
Poison hemlock	*Conium maculatum*	A		
Puncturevine	*Tribulus terrestris*	A		
Purple loosestrife	*Lythrum salicaria*	A	Mandatory control, Potential invader	Y[2]
Quackgrass	*Elytrigia repens*	A		
Redstem filaree	*Erodium cicutarium*	A		
Rush skeletonweed	*Chondrilla juncea*	A, C		
Russian knapweed	*Centaurea repens*	A, B	Mandatory control	Y
Russian-olive	*Elaeagnus angustifolia*	A		
Russian thistle	*Salsola collina and S. iberica*	A		
Saltcedar	*Tamarix parviflora and T. ramosissima*	A		
Scentless chamomile	*Anthemis arvensis*	A		
Scotch thistle	*Onopordum acanthium and O. tauricum*	A	Recommended control	Y
Sericea lespedeza	*Lespedeza cuneata*	A, C		
Shepherdspurse	*Capsella bursa-pastoris*	A		
Spotted knapweed	*Centaurea maculosa*	A	Mandatory control	Y
Spurred anoda	*Anoda cristata*	A, C		
Squarrose knapweed	*Centaurea virgata*	A, C	Potential invader	
Sulfur cinquefoil	*Potentilla recta*	A, C	Potential invader	
Swainsonpea	*Sphaerophysa salsula*	A		
Tansy ragwort	*Senecio jacobaea*	A, C		
Velvetleaf	*Abutilon theophrasti*	A		
Venice mallow	*Hibiscus trionum*	A, C		

Table G–1 Noxious Weed Lists (State of Colorado, La Plata County, and Archuleta County)

Common Name	Scientific Name	Colorado State List[1]	La Plata County List	Archuleta County List
Wild caraway	*Carum carvi*	A		
Wild mustard	*Brassica kaber*	A		
Wild oats	*Avena fatua*	A		
Wild proso millet	*Panicum miliaceum*	A		
Yellow foxtail	*Setaria glauca*	A		
Yellow nutsedge	*Cyperus esculentus*	A		
Yellow starthistle	*Centaurea solstitialis*	A, C	Potential invader	
Yellow toadflax	*Linaria vulgaris*	A, B	Mandatory control	Y

Notes:

1. A: These weed species are identified as State Noxious Weeds. They have been identified by individual counties as problem weeds in the county's area or have been recommended for management through public testimony. These weed species should be considered by each local advisory board and local governing body in the development, adoption, and enforcement of their noxious weed list and noxious weed management plan.

   B: These weed species are recognized as the top ten prioritized weed species for the State of Colorado. After analysis of a statewide survey of counties, these species are acknowledged to be the most widespread and to cause the greatest economic impact in the State of Colorado. These species shall be considered by each local advisory board and local governing body in the development, adoption, and enforcement of their noxious weed list and noxious weed management plan.

   C: These weed species may not be present or are not yet widespread or causing great economic impact within the State of Colorado. However, counties and local advisory boards are encouraged to contain and eradicate these species before they proliferate and significantly impact the economic and environmental values of the lands of the State.
2. Not yet identified in Archuleta County, but a real threat.

Appendix H
Biological Assessment

BIOLOGICAL ASSESSMENT

NORTHERN SAN JUAN BASIN COAL BED METHANE DEVELOPMENT ENVIRONMENTAL IMPACT STATEMENT

OCTOBER 23, 2003

United States Department of Agriculture
Forest Service
United States Department of the Interior
Bureau of Lad Management

San Juan Public Lands
Archuleta and La Plata Counties

Prepared by:

Anthony Garcia, District/Field Office Wildlife Biologist
Columbine Ranger District/Field Office

Dave Gerhardt, Forest Fisheries Biologist
San Juan Public Lands Center

Matt Schweich, Senior Ecologist
Greystone Environmental Consultants, Inc.

Jeff Redders, Forest Ecologist
San Juan Public Lands Center

INTRODUCTION

Section 7 of the Endangered Species Act (ESA) [16 USC 1531 et seq.] outlines the procedures for federal interagency cooperation to conserve federally listed species and designated critical habitats. Section 7(a)(2) of the ESA states that each federal agency, in consultation with the Secretary of the Interior or Secretary of Commerce, must ensure that any action it authorizes, funds, or carries out is not likely to jeopardize the continued existence of a listed species or result in the destruction or adverse modification of designated critical habitat. Section 7(c) of the ESA requires that a Biological Assessment (BA) be prepared if listed species or critical habitat may be present in a Project Area to assess whether the proposed action may affect a listed species or its critical habitat.

This BA is being prepared in accordance with the legal requirements set forth under Section 7(c) of the ESA, and USFS and BLM Manual direction to address potential effects to listed species from proposed Coal Bed Methane Development and associated activities addressed in the Northern San Juan Basin Coal Bed Methane Environmental Impact Statement (hereafter referred to as EIS). The EIS addresses Coal Bed Methane development across portions of the San Juan National Forest (SJNF), San Juan Field Office (BLM), private, and state lands.

Purpose

This BA is intended to review the proposed action in sufficient detail to evaluate whether implementation of the proposed project will affect any species that are listed under the ESA, their critical habitats, or any species proposed for listing. To achieve this objective, this BA reviews the proposed action (the Northern San Juan Basin Coal Bed Methane Environmental Impact Statement) in sufficient detail to identify the level of effect that will occur to each species evaluated. One of three possible determinations will be chosen for listed species based on the best available scientific literature, a thorough analysis of the potential effects of the project, and the professional judgment of the wildlife and fisheries biologists, and ecologists who completed the evaluation. The three possible determinations (U.S. Fish and Wildlife Service [FWS] and National Marine Fisheries Service 1998) are as follows:

- "No effect" – where no effect is expected;
- "May affect not likely to adversely affect" – where effects are expected to be beneficial, insignificant (immeasurable), or discountable (extremely unlikely); and
- "May affect likely to adversely affect" – where effects are expected to be adverse or detrimental.

CONSULTATION HISTORY

Several projects have undergone Section 7 Consultation with the FWS in the Northern San Juan Basin Coal Bed Methane Project Area (hereafter referred to as the Project Area).

The first of these consultations was the BA for the Expansion of Gas Extraction Facilities in the HD Mountains, dated March 1992 (U.S. Forest Service 1992). The 1992 BA concluded that there would be no effect on the peregrine falcon and black-footed ferret. It also concluded that the proposed project may affect but was not likely to adversely affect the bald eagle, Mexican spotted owl, and Colorado pikeminnow. No other threatened or endangered species were included in the BA.

The second consultation was in January of 1996. The SJNF completed a programmatic Biological Assessment for historic water depletions authorized by the Forest. The Assessment addresses the adverse effects of water depletions to the two listed fish species, the Colorado pikeminnow and the razorback

sucker, which occupy the lower San Juan River and can be affected by Forest Service actions upstream of the occupied habitat. In March of 1996, the Fish and Wildlife Service provided the Forest with a Biological Opinion including "reasonable and prudent alternatives" addressing these actions (GJ-6-CO-96-F-003). These two documents provide a comprehensive analysis of species life histories, status of populations, limiting factors, and effects rationale. Subsequent Forest Service actions and assessments tier to these documents, reducing the need to reiterate much of the historic information. This Assessment also tiers to those evaluations.

The third consultation was for prescribed natural fire and management ignited fire actions addressed in a BA titled Biological Assessment for Federally Listed Wildlife Species Prescribed – Prescribed Fire Plan San Juan/Rio Grande National Forests and San Luis Valley/San Juan Resource Area (U.S. Forest Service 1996a). In this BA, a determination of no effect was made for the southwestern willow flycatcher, whooping crane, American bald eagle, American peregrine falcon, Mexican spotted owl, and black-footed ferret. A may affect and likely to adversely affect determination was made for Colorado squawfish, razorback sucker, humpback chub, and bonytail resulting from 5 acre-feet per year of water being depleted from the San Juan Basin and 5 acre-feet per year depleted from the Dolores River Drainage in the Upper Colorado River Basin. The FWS responded in a letter dated October 28, 1996 (ES-6-RO-95-F-001-GJ141, MS 65412 GJ), and a Biological Opinion (ES/FS GJ-6-CO-96-F-020, CO/KS/NE/UT) concurring with these determinations.

Upon further evaluation, the SJNF submitted a revised BA for the Mexican Spotted Owl and Southwestern Willow Flycatcher – Prescribed Fire Plan, San Juan/Rio Grande National Forests and San Luis Valley/San Juan Resource Area (U.S. Forest Service 1996b). The SJNF concluded in this document that prescribed natural and management ignited fire actions may affect but are not likely to adversely affect the spotted owl, with the effects from these actions being beneficial. The BA also concluded that that there would be no effect to the Southwestern Willow Flycatcher. The FWS responded in a letter dated January 22, 1997 (ES/CO:FS-SJ/RG NF- Pagosa RD, MS 65412 GJ) concurring with these determinations.

The fourth consultation occurred in May 2001. The Forest completed consultation with the FWS on two CBM lease parcels in the Pargin Mountain area, including an estimated 45 CBM wells located within the current Project Area. Water depletions associated with the 45 wells was estimated at 29 acre-feet per year from the Piedra River. These wells are now included as part of the current proposed action. The 29 acre-feet associated with the 2001 Biological Opinion (ES-6-RO-01-F-SJ001) are included in the 216 acre-feet estimate described below.

PROPOSED ACTION

This section describes the Project Area, the proposed action, and the types of activities associated with the proposed action.

Introduction

Eight companies (the Companies) propose further development of coal bed methane (CBM) associated with coals of the Fruitland Formation in La Plata and Archuleta Counties in southwestern Colorado. Under the proposed action, the Companies will drill and operate additional CBM wells and will build the necessary ancillary facilities, such as roads, pipelines, and compressor stations.

The Companies hold valid federal, state, and private leases for oil and natural gas in the Project Area. The leases have created contractual and property rights for the Companies from the United States, the State of

Colorado, and private mineral landowners to develop oil and natural gas resources. The Companies' proposal will expand drilling and production of CBM to additional locations on approved leases in response to the changes in well spacing rules adopted in May 2000 by BLM and in July 2000 by the Colorado Oil and Gas Conservation Commission (COGCC). In addition, the proposal is in response to the desire to expand CBM production to locations that are not currently developed within the Project Area.

Project Area

The Project Area consists of the 125,000-acre portion of the San Juan Basin north of the Southern Ute Indian Reservation (See Maps Provided). Land ownership in the Project Area includes 7,000 acres of federal lands administered by San Juan BLM, 50,000 acres of federal lands administered by the SJNF, 13,000 acres of private (fee) lands with federal minerals, and 55,000 acres of private and state lands with non-federal minerals.

Proposed Action

Five alternatives were developed to respond to the legal and policy requirements and to the issues identified through public scoping. The alternatives also cover the range of possibilities for development. Each of these alternatives was initially considered practical or feasible from a technical or environmental perspective. These alternatives include the Industry Proposed Action (Alternative 1), Maximum Development (Alternative 2), No New Development in the HD Mountains Inventoried Roadless Area (Alternative 3), Continuation of Current Management Direction (Alternative 4), and No Action (Alternative 5). The Industry Proposed Action (Alternative 1) is selected as the preferred alternative for this analysis and consultation. This alternative will be referred to as the proposed action throughout the remainder of this BA.

The proposed action is the proposal for CBM development put forth by the Companies. Under the proposed action, the Companies will drill, complete, operate, decommission, and reclaim 296 new CBM wells, which will be drilled from 273 well pads. The CBM gas field will be developed to a density of four wells per section throughout most of the Project Area. The Companies propose limited development in the Spring Creek area of the SJNF, however. Surface occupancy will be avoided on 25 well windows in the HD Mountains because of the steep slopes and inaccessible terrain, but wells will be directionally drilled to those locations. The Companies will construct 128.1 miles of access road and gathering lines, 3.5 miles of pipeline that is not collocated with roads, seven disposal wells, and 10 compressors. Short-term disturbance will equal 1,151.8 acres, and long-term disturbance will equal 708.3 acres. Table 1 shows, by land ownership, the details of the facilities proposed and the amount of short- and long-term disturbance from each facility. Short-term disturbance is the period from 0-3 years, and long-term disturbance is from 4-33 years.

Table 1. Summary of proposed wells and ancillary facilities under Alternative 1 – Industry Proposed Action.

Facility	Number	Direct Ground Disturbance (acres) [1]	
		Short-Term	Long-Term
CBM Wells			
BLM Lands	12	N/A[2]	N/A
National Forest System Lands	185	N/A	N/A
State Land	7	N/A	N/A

Table 1. Summary of proposed wells and ancillary facilities under Alternative 1 – Industry Proposed Action.			
Facility	**Number**	**Direct Ground Disturbance (acres) [1]**	
		Short-Term	**Long-Term**
Private Lands	92	N/A	N/A
Total	296	N/A	N/A
CBM Well Pads			
BLM Lands	12	16.8	12.0
National Forest System Lands	162	234.9	170.1
State Lands	7	9.8	7.0
Private Lands	92	128.8	92.0
Total	273	390.3	281.1
Roads/Pipelines (length in miles)			
BLM Lands	3.0	14.5	9.1
National Forest System Lands	89.9	435.9	272.4
State Lands	1.0	5.1	3.2
Private Lands	21.8	105.7	66.0
Total	115.7	561.2	350.6
Pipelines (length in miles)[3]			
BLM Lands	0.0	0.0	0.0
National Forest System Lands	6.9	33.7	0.0
State Lands	0.0	0.0	0.0
Private Lands	0.1	0.3	0.0
Total	7.0	34.0	0.0
Produced Water Disposal Wells			
BLM Lands	0	0.0	0.0
National Forest System Lands	1	2.0	1.6
State Lands	0	0.0	0.0
Private Lands	0	0.0	0.0
Outside the Project Area	2	4.0	3.2
Undetermined Location	4	8.0	6.4
Total	7	14.0	11.2
Trunk Pipelines (length in miles)			
Undetermined Location	17	82.4	0.0
Total	17	82.4	0.0
Compressors Stations			
BLM Lands	0	0.0	0.0
National Forest System Lands	7	21.0	21.0
State Lands	2	6.0	6.0

Table 1. Summary of proposed wells and ancillary facilities under Alternative 1 – Industry Proposed Action.			
Facility	**Number**	**Direct Ground Disturbance (acres) [1]**	
		Short-Term	**Long-Term**
Private Lands[4]	1	3.0	3.0
Outside the Project Area	1	3.0	3.0
Undetermined Locations	0	0.0	0.0
Total	10	33.0	33.0
Total Horsepower	42,500	N/A	N/A
Total Disturbance	N/A	1,151.8	708.3

Notes:
[1] Totals may not match precisely with values obtained by adding unit numbers based on rounding conventions.
[2] N/A = Not applicable.
[3] Pipelines not associated with roads
[4] Two proposed engines are located on existing stations and are therefore not included in this estimate of disturbance.
Source: Table 2-1 in Chapter 2 of the Draft Environmental Impact Statement for the Northern San Juan Basin Coal Bed Methane Project.

The proposed action includes both specific well locations and general drilling windows, which are plots of 27 acres where the exact well location is not yet known but the general area has been identified. For these locations, assumptions on locations for well pads, roads, and pipelines were made. In several cases, drilling windows contain more than one surface or mineral ownership (or both), as well as different surface resources (for example, vegetation types and wildlife habitats). The amount of wells, roads, and other facilities that will be located on a specific surface or mineral ownership or that will affect a certain resource was assumed to be in proportion to the presence of the ownership or resource in all drilling windows in the Project Area. Specific activities that will be part of the proposed action, as discussed below, were used to assess its effects on all species evaluated in detail in this BA.

Project Activities

The overall life of the proposed action will be approximately 30 years. Well construction will begin during 2004, and drilling will continue for 5 years. The productive life of each well is expected to be 25 to 30 years. Production from the wells drilled at the end of the 5-year drilling period is therefore expected to conclude by 2038. Final reclamation of each well will occur during the 2 to 3 years immediately after the end of its productive life. Thus, the proposed action will be completed by 2040.

Well Development

Well development consists of a number of sequential phases, as described below. Each of these phases is described in detail in Chapter 2 of the EIS.

Pre-construction Phase

In the pre-construction phase, the well location is identified and an on-site inspection is conducted. An Application for Permit to Drill (APD) is submitted to the regulating agency and is generally approved with conditions attached after the required environmental analysis has been completed. During this phase, the need for biological surveys is assessed, surveys are conducted if necessary, the results of the surveys are reviewed, and any additional mitigation measures are developed and incorporated as conditions of approval for the APD.

Development and Construction Phase

During the development and construction phase, access roads, well pads, and ancillary production facilities such as pipelines for gas and produced water, electrical facilities, disposal sites, and compressor stations will be constructed. The length of the access roads will average ¼ mile for private and state lands, ⅓ mile for BLM lands, and ½ mile for FS lands. The average width of a road that accesses a well pad will be 25 feet. Access roads will disturb 0.8 acres per well on private or state surface, 1 acre per well on BLM lands, or 1.5 acres per well on FS lands. Water will be used to abate dust and for other construction practices. Approximately 60 acre-feet of water will be used in total during construction of roads, pipelines, well pads, and compressor facilities. Water will be drawn from existing local sources; no new withdrawals of groundwater or surface water are planned.

The disturbance associated with each well pad will vary with the number of wells drilled from the pad. Pads with a single well will cause 1.4 acres of disturbance. The disturbance will increase by about 25 percent with each additional well on a pad. Therefore, pads with two wells will disturb 1.75 acres, and pads with three wells will disturb 2.1 acres.

Gathering pipelines will parallel existing or proposed roads, where possible. The right of way (ROW) will be reclaimed as soon as weather and growing conditions are favorable after the pipelines have been installed and tested. Pipelines for gathering gas and produced water will require a 40-foot ROW, all of which will be reclaimed. Construction will disturb 4.85 acres per mile of pipeline.

Electricity may be used during the development and production phases. Generators will be used where electricity is not otherwise available. In most cases, distribution lines will connect wells and compressor facilities with the existing transmission and distribution system. These lines will be installed within a 20-foot wide ROW, of which 5 feet will overlap with the adjacent access road. The remaining 15 feet will be new disturbance that will be reclaimed after construction is complete. Construction will disturb 1.82 acres per mile of distribution line.

Each compressor station will cause 6 acres of long-term disturbance over the life of the project. Two stations will require construction of trunk pipelines to connect them to existing pipelines. Although the specific routes have not been identified, the Companies have estimated that 17 miles of new pipeline will be required. These pipelines will disturb 82 acres of surface area. No long-term disturbance is anticipated because all components of the pipelines will be buried and the surface will be revegetated.

The pads for some disposal wells may be collocated with the compressor units on a compressor station, so that no additional disturbance would be required. An access road, pipeline for produced water, and possibly an electrical distribution line will be constructed to each disposal well. An area of 3 acres will be disturbed over the life of the project where disposal wells are not collocated with compressors.

Drilling and Completion Phase

The access road and well pad will be reclaimed if the well is not successfully completed. If the well is completed successfully, gravel will be used to surface all newly constructed roads to ensure a surface that is adequate for year-round travel.

The Companies propose to use three to four drilling rigs continuously during the year in the western portion of the Project Area. The Companies will use four rigs, limited to seasonal restrictions, on the eastern portion. Drilling each well will likely involve about 6 to 12 days and an estimated 6 to 19 workers. The drill rig, other equipment, and supplies will be trucked to the well pad.

After each well is drilled and completed, the Companies will reclaim the parts of the pad and reserve pit that are not needed for production. Based on information for CBM wells completed to date, about 0.4 acre of each pad will be reclaimed. The rest of the pad (1 acre) will comprise long-term disturbance for the life of the project.

After a well is drilled, the Companies will initiate a completion and testing program using a completion rig. The program will last 7 to 14 days, and include perforating the well's steel casing, hydraulically fracturing the producing formation, and installing production pipe connected to a series of valves and fittings on the well head.

Production and Maintenance Phase

Access roads will be routinely maintained year-round or as site conditions permit. Dust abatement procedures will not be routinely employed on the roads during production and maintenance. The counties will continue to maintain existing county roads, and the Companies will maintain all other project-related roads.

Surface production facilities installed at the well site will include the well head, a pump, separators or dehydrators, gas metering facilities, produced water tanks, and a connection to the gas- and produced water-gathering systems. The total area that will be used for long-term production operations at a single well pad will occupy 1 acre or less. All areas that are not needed for production facilities will be covered with the topsoil that was stored during the previous construction phase. Interim reclamation of these areas will take place as soon as weather and growing conditions are favorable. Company personnel or contractors will visit each producing well daily to ensure that equipment is functioning properly. Some companies may supplement these efforts with remote monitoring.

Periodically, a well may require a work-over. These repairs will occur during daylight only and usually will be completed in several days. In some limited situations, however, several weeks may be required to finish a work-over. The frequency for this type of work cannot be accurately projected because work-overs vary between wells, depending on the circumstances. Therefore, one 14-day work-over per year per well is assumed.

The total water production for the proposed wells located in the eastern portion of the Project Area will average about 75 barrels per day per well. In the western portion of the Project Area, rates of production will vary from 100 to 200 barrels of water per day per well. The Companies will dispose of produced water by transporting it by truck or pipeline to approved disposal wells. Alternatively, some of the water produced by the wells on the eastern side of the Project Area may be held in evaporation pits located outside of the Project Area or possibly discharged to surface drainages. However, surface discharge is currently considered speculative because treatment requirements and costs are unknown. Therefore, additional analysis and permitting will be required before any surface discharge can occur.

Decommissioning and Reclamation Phase

The alternatives assume that each well will continue to produce during its 25 to 30-year economic lifetime. Any dry holes will be reclaimed following the procedures described below except that reclamation will begin as soon as possible after the Companies conclude that the well will not economically produce.

Similar reclamation procedures will be applied in all disturbed areas. First, gravel surfaces will be removed. Then, disturbed areas will be backfilled as needed and graded to the desired configuration. Erosion control measures will be installed, if necessary. All road disturbances will be revegetated with a

seed mixture approved by the Authorized Officer or landowner. All seed will be certified as free of weeds. Next, the surface will be tilled and prepared for seeding. Finally, seeding and planting will be repeated until satisfactory revegetation is achieved.

Access roads will be closed unless the landowner or land manager wishes to make use of them and accepts responsibility for future maintenance. All aboveground facilities and equipment will be disassembled and removed from the site. These aboveground facilities include the well equipment, compressors, amine and dehydration units, and buildings. Pipelines will be cleaned, disconnected, plugged, and then abandoned in place to avoid unnecessary disturbance of the land surface. Likewise, underground power lines will be disconnected and abandoned in place to avoid unnecessary surface disturbance. Aboveground facilities related to the underground power lines will be removed, and any disturbance associated with these facilities will be reclaimed. Aboveground electrical power lines will be disconnected, and the power poles and lines will be removed. Disposal wells will be abandoned and reclaimed.

COMMITTED CONSERVATION MEASURES

The EIS specifies two levels of environmental protection measures. The first level includes the mitigation measures described in Chapter 3 of the EIS that apply to implementation of the project in general. The second level includes mitigation measures that are applied to specific well locations after the Companies have filed APDs and site inspections have been completed. The APDs a Company submits must be consistent with the environmental protection measures set forth in the EIS and will be modified to address specific issues that are identified during on-site inspections of the proposed well site.

Three categories of activities are specified in the committed conservation measures: (1) construction activities that would be prohibited during periods of the year or within proximity to certain occupied habitats; (2) routine well activities that include daily site visits, minor repairs of surface equipment, or removal of produced water by trucks; and (3) activities that would be necessary to maintain production, including emergency work-overs such as pump replacement and repair, clearing plugged tubing, swabbing, or associated operations to unload fluids from a well, well bore repair, and repair of surface equipment to ensure environmental protection. These activities would be limited to daylight only and would be short.

The Companies have agreed to implement committed conservation measures on private land and are subject to these measures on federal lands. The Companies, in turn, reserve the right to conduct activities required to maintain production on private land throughout the year, restricted to work during daylight. On public land, these same production maintenance activities are subject to Authorized Officer approval on a case-by-case basis.

The following measures that apply to federally listed species have been identified in the EIS. They apply to the bald eagle, southwestern willow flycatcher, Colorado pikeminnow and razorback sucker, and Knowlton's cactus:

Bald Eagle

- Conduct surveys of nesting and potential roosting areas during appropriate seasons each year before site-specific project activities begin to determine if nest and roosting sites are active. Times and locations for these surveys shall be established in consultation with the Authorized Officer.

- Construct well pads, compressor stations, and ROWs at least ¼ mile from active bald eagle nests and active winter roosts.

- Restrict activities other than routine maintenance that could disturb nesting within ½ mile of an active bald eagle nest between January 1 and July 1.

- No activities other than routine well activities (activities that are conducted in the course of maintaining production operations at a well site such as daily site visits, minor repairs on surface equipment or removal of produced water by truck) shall take place within bald eagle winter concentration areas between November 15 and March 15, unless approved by the Authorized Officer. If the Authorized Officer approves routine well activities within bald eagle winter concentration areas between November 15 and March 15, it shall be restricted to a period between 9:00 a.m. and 3:00 p.m. local time.

- Emergency work-overs that are necessary and proposed to take place between November 15 and March 15 in bald eagle winter concentration areas, such as pump replacement/repair, plugged tubing, swabbing or associated operations to unload fluids from a well, a hole in the tubing or activities to repair a wellbore and/or surface equipment in order to ensure environmental protection will be approved by the Authorized Officer. These activities are limited to daylight hours only and will be of short duration.

- Avoid removal of large cottonwood, ponderosa pine, or other trees within bald eagle winter concentration areas, winter roosts, and areas that may provide nesting habitat.

- Construct aboveground power lines using raptor protection measures (Avian Power Line Interaction Committee [APLIC] 1994, APLIC 1996) that are designed to reduce the potential for avian collision and electrocution.

Mexican Spotted Owl

- Implement Mexican spotted owl management guidelines according to the Mexican Spotted Owl Recovery Plan should any breeding or resident owls be discovered in the Project Area (U.S. Fish and Wildlife Service 1995b).

Southwestern Willow Flycatcher

- Conduct surveys for the southwestern willow flycatcher during the pre-construction phase. Times and location of surveys shall be established in consultation with the Authorized Officer (breeding surveys will occur between May 15 and July 20, and will be in accordance with the latest FWS protocol). In the absence of completed and approved surveys, all suitable southwestern willow flycatcher habitats shall be assumed to be occupied.

- Prohibit disturbance to occupied southwestern willow flycatcher habitat by siting facilities a minimum of 100 meters away from such habitat. If birds are located during survey efforts, no surface disturbing activities would be conducted from May 1 to August 15.

- Avoid disturbance to suitable southwestern willow flycatcher habitat by siting facilities a minimum of 100 meters away from such habitat.

- Minimize construction in wooded riparian habitats.

- Best Management Practices (BMPs) for riparian/wetland areas will be implemented to avoid adverse impacts to these habitats.

Colorado Pikeminnow/Razorback Sucker

- Use BMPs to avoid contamination of local streams and rivers to protect the Colorado pikeminnow and razorback sucker.

Knowlton's Cactus

- A professional botanist who hold a college degree in botany will conduct pre-construction surveys for Knowlton's cactus in all potential areas of disturbance that are identified as suitable habitat (all lands within the pinyon-juniper and sagebrush vegetation types, and all other lands below 8000 feet in elevation) during the pre-construction phase of the project. Since Knowlton's cactus is extremely inconspicuous except when in flower, pre-construction surveys for Knowlton's cactus will occur between April 1 and May 15 when the species is most likely to be flowering.

- Avoid Knowlton's cactus plants and populations and the buffers around them that may be affected by activities.

SPECIES CONSIDERED AND SPECIES EVALUATED

Species Considered but Eliminated from Detailed Evaluation

Species addressed in this BA are based on a list confirmed with the U.S. Fish and Wildlife Service on March 3, 2003 (U.S. Fish and Wildlife Service 2003a). The March 3, 2003 list includes the 12 species that are identified in Table 2.

All species discussed in Table 2 were evaluated for their potential to occur in the Project Area. This evaluation concluded that six of these species are not expected to occur because the Project Area is either outside their range, does, not contain any potential habitat, or will not be affected by the proposed action. These species include Canada lynx, bonytail chub, humpback chub, Uncompahgre fritillary butterfly, Mancos milkvetch, and Mesa Verde cactus. **This group of species will not be affected by the proposed project, and a determination of "no effect" is appropriate.** These species therefore have been eliminated from further detailed evaluation. The rationale for this elimination is discussed for each species below.

Table 2. Federally listed species for the San Juan Public Lands confirmed on March 3, 2003 with the U.S. Fish and Wildlife Service.

Species Group	Status	Potential for Occurrence on Forest Service Lands	Potential for Occurrence on BLM Lands
Birds:			
Bald eagle, *Haliaeetus leucocephalus*	Threatened	Yes	Yes

Table 2. Federally listed species for the San Juan Public Lands confirmed on March 3, 2003 with the U.S. Fish and Wildlife Service.			
Species Group	**Status**	**Potential for Occurrence on Forest Service Lands**	**Potential for Occurrence on BLM Lands**
Birds:			
Mexican spotted owl, *Strix occidentalis lucida*	Threatened	Yes	Yes
Southwestern willow flycatcher, *Empidonax traillii extimus*	Endangered	Yes	Yes
Fish:			
Bonytail, *Gila elegans*	Endangered	Yes	Yes
Colorado pikeminnow, *Ptychocheilus lucius*	Endangered	Yes	Yes
Humpback chub, *Gila cypha*	Endangered	Yes	Yes
Razorback sucker, *Xyrauchen texanus*	Endangered	Yes	Yes
Mammals:			
Canada lynx, *Lynx Canadensis*	Threatened	Yes	Yes
Plants:			
Knowlton's cactus, *Pediocactus knowltonii*	Endangered	Yes	Yes
Mancos milkvetch, *Astragalus humillimus*	Endangered	No	Yes
Mesa Verde cactus, *Sclerocactus mesae-verdae*	Threatened	No	Yes
Insects:			
Uncompahgre fritillary butterfly, *Boloria acrocnema*	Endangered	Yes	No

Canada Lynx

The Canada lynx is a federally listed threatened species (U.S. Fish and Wildlife Service 2000a). This species also is listed as endangered by the State of Colorado. Lynx occupy regions in North America of arctic or boreal influence. They are restricted to forested habitats within this region and are found from western Alaska to the eastern edge of Newfoundland and south in the Rocky Mountains to Utah and Colorado (Koehler and Aubry 1994). There are only 18 historical documented records of lynx in

Colorado. Furthermore, it is generally assumed that lynx have always been rare in Colorado. No structured forest-wide inventories on the SJNF have been conducted for the lynx, however. The Colorado Division of Wildlife (CDOW) has conducted a winter tracking survey that covers positive and probable lynx sightings recorded in its databases, which includes areas on the SJNF. The project covered about 500 square miles over a 3-year period (1992 through 1995) and used bait stations and remote cameras. No evidence of lynx was found in any of these investigations.

CDOW began a lynx augmentation program in southwestern Colorado in the winter of 1999 and continued releases in 2000 and April 2003. More than 129 lynx have been released in 1999, 2000, and 2003, and 83 are still alive (Shenk 2003). All of these releases have occurred in the eastern portion of the SJNF, on the Pagosa and Columbine Ranger Districts, as well as in the Divide Ranger District of the Rio Grande National Forest. The individuals released to date are being closely monitored and appear to be dispersing over a large area. There is no evidence that dispersing re-introduced lynx have moved into the Project Area, however. Instead, most of the lynx released in spring 2003, as well as the lynx from the 1999 and 2000 releases, remain in the core area: New Mexico north to Gunnison, west as far as Taylor Mesa and east to Monarch Pass. Some lynx have moved into New Mexico as well. There are at least eight lynx north of Gunnison up to the I-70 corridor and in the Taylor Park area. At least four lynx are currently north of I-70 as of summer 2003.

Lynx Analysis Units (LAUs) are designated in areas of suitable lynx habitat and form the basis for managing lynx and their habitats. No LAUs have been designated in the Project Area. Although areas of potential lynx habitat exist in the eastern third of the Project Area, they are too small and isolated to support lynx, as evidenced by the lack of LAU designation. Use of the Project Area by lynx is unlikely.

Bonytail Chub

The bonytail chub is a federally listed endangered species. It is also listed as endangered by the State of Colorado. There is no designated critical habitat for the bonytail chub in the San Juan River Basin (U.S. Fish and Wildlife Service 1994a). Instead, the historical range of the bonytail chub extends through both the upper and lower Colorado River basins. The current range of the species has been greatly reduced from the historical range, however. Since 1980, only a handful of specimens have been captured in the upper Colorado River system. Occurrence of bonytail chub in the San Juan River drainage is uncertain, as the scientific record consists only of skeletal remains from Native American middens and two questionable specimens collected before 1930 (U.S. Fish and Wildlife Service 1995a). This species is not expected to occur in the Project Area or downstream in the San Juan River.

Humpback Chub

The humpback chub is a federally listed endangered species. It is also listed as threatened by the State of Colorado. There is no designated critical habitat for the humpback chub in the San Juan River Basin (U.S. Fish and Wildlife Service 1994a). The humpback chub historically inhabited canyons of the Colorado River and its tributaries. No evidence suggests that the humpback chub ever inhabited the San Juan River Basin. This species is not expected to occur in the Project Area or downstream in the San Juan River.

Uncompahgre Fritillary Butterfly

The Uncompahgre fritillary butterfly is a federally listed endangered species. This extremely rare butterfly is found only in alpine areas of Colorado, including the San Juan Mountains and Sawatch Range. All currently known colonies are located above 12,500 feet and are restricted to patches of snow willow (*Salix nivalis*) (U.S. Fish and Wildlife Service 1994b). The highest elevations of the Project Area

are at about 9,000 feet, and no habitats of the type required by this species are found in the Project Area; therefore, this species is not expected to occur.

Mancos Milkvetch

The Mancos milkvetch is a federally listed endangered species. The only known occurrences of this species are found 18 to 25 miles southwest of Cortez, in Montezuma County. There are no known occurrences of this species in the Project Area. No officially designated critical habitat has been identified for Mancos milkvetch. Pinyon-juniper woodlands are the preferred habitat for this species. Although pinyon-juniper woodlands exists in the Project Area, the Mancos milkvetch is known to occur at elevations of about 5500-5850 feet, much lower than the elevations that occur in the Project Area. The Mancos milkvetch is associated with the Point Lookout Sandstone Formation, which does not occur in the Project Area. This species is not expected to be found in the Project Area because suitable habitat is not present (as described above), because surveys done in the Project Area have not found it, and because of the large distance between known occurrences and the Project Area.

Mesa Verde Cactus

The Mesa Verde cactus is a federally listed threatened species. The only known occurrences of this species are found 11 to 32 miles southwest of Cortez, in Montezuma County. There are no known occurrences of this species in the Project Area. No officially designated critical habitat has been identified for Mesa Verde cactus. Shale or clay badlands of the Mancos and Fruitland Formations are the preferred habitats for this species. Although these habitats exist in the Project Area, the Mesa Verde cactus is known to occur at elevations of about 4000-5000 feet, much lower than the elevations that occur in the Project Area. This species is not expected to be found in the Project Area because suitable habitat (as described above), is not present, because surveys done in the Project Area have not found it, and because of the large distance between known occurrences and the Project Area.

Species Evaluated in Detail

The remaining species occur, or have potential to occur in the Project Area based on known occurrences of, or the presence of suitable habitats for these species. These species and the extent of their habitats in the Project Area are summarized in Table 3. The potential effects of the proposed action on these species have been evaluated in detail and are discussed in the following sections. General information is reviewed for each species, including its status, distribution, life history, and factors of concern. The Affected Environment includes a summary of past and present impacts on each species of federal, state, and private actions and other human activities in the Project Area (including past and on-going CBM development). Direct, indirect, and cumulative effects of the proposed action on each species are discussed. Finally, a determination of the effects on the species is made.

Table 3. Extent of documented habitats for each species in the Project Area.

Species	Extent of Habitat (acres)
Bald eagle	11,554[1] There are 243 acres of winter roosting habitat outside the Project Area.
Mexican spotted owl	1,980 acres of marginally suitable habitat. 10,535 acres (in various vegetation types) surveyed in 2002 and 2003.

Southwestern willow flycatcher	534[2]
Colorado pikeminnow and razorback sucker	San Juan River[3]
Knowlton's cactus	See effects analysis

1 Winter Concentration Area. There are no designated winter roost or nesting areas in the Project Area.
2 Includes 457 acres of suitable habitat and 67 acres of potential habitat.
3 Downstream of the Project Area.

Bald Eagle

Status: The FWS listed the bald eagle as an endangered species in February 1978. In July 1995, the eagle was reclassified as threatened in the lower 48 states. The bald eagle has been proposed for delisting in the future because of the success of recovery efforts, but remains classified as threatened at this time. This species is also listed as threatened by the State of Colorado.

Distribution: The bald eagle historically ranged across North America, although it's breeding range contracted during the 19th and 20th centuries. Historical records indicate that the bald eagle formerly nested in at least 45 of the contiguous 48 states. As of 1981, nesting birds were found in only 30 states, with 90 percent of the 1,250 known pairs occurring in just 10 states at that time.

Wintering populations of bald eagles in Colorado number between 400 and 700 (Andrews and Righter 1992). These birds are most frequently seen near larger streams, rivers, lakes, and reservoirs. Although proximity to water is typical, roosting at some distance from water is known to occur in Colorado. They may also be observed hunting in upland areas, particularly in the brushy habitats of western Colorado (Towry 1984). Although the bald eagle is a relatively common winter resident of Colorado, only sporadic nesting occurs here.

There are no known bald eagle nests in the Project Area, although several nests are known nearby. One active bald eagle nest site is near the boundary of the SJNF on private lands north of Durango, 5 miles northwest of the Project Area. Two nest sites are located on the Pine River south of the Project Area. Another nesting site is located west of Navajo Reservoir near the town of Allison, 8 miles south of the Project Area. Bald eagles have been observed along the Piedra River during the summer, but no nesting has been reported within the drainage.

An adult bald eagle was observed roosting in a tree in the Sauls Creek area, several miles from the nearest large body of water, during field work for the project in November 2002. Wintering populations occur along all of the larger stream systems in the Project Area, including the Animas, Florida, Pine, and Piedra Rivers primarily on private lands (See Map Provided). CDOW has delineated bald eagle winter concentration areas as a 1-mile buffer along all four of these rivers in the Project Area. A total of 11,554 acres of winter concentration areas have thus been delineated in the Project Area with the majority located on private lands. A winter concentration area is defined as: "areas (trees, islands, etc.) within an existing winter range where eagles concentrate between November 15 and April 1. These areas may be associated with roost sites" (CDOW 1997). CDOW has not defined winter roosts in the Project Area, although one has been defined 3 miles east, along Stollsteimer Creek. The CDOW has also delineated winter range areas. The entire Project Area is considered bald eagle winter range. Bald eagle winter range is defined as areas where bald eagles have been observed between November 15 and April 1.

Life History: The only cover requirements for bald eagles are large, open-branched trees (preferably near lakes, reservoirs, or rivers) for hunting perches and roosting sites. Bald eagles build large, heavy nests in tall, usually living trees, generally near water. In this area, cottonwoods and sometimes ponderosa pines

are used for nesting. If suitable trees are unavailable, nests are built on rocky cliffs or even on the ground (DeGraaf et al. 1991).

The primary characteristic of winter habitat is an abundant and available food supply in conjunction with one or more suitable night roost sites. Although a roost site may be used regularly during the winter season, repeated use in subsequent winters does not necessarily occur. In wintering areas, bald eagles commonly roost in large groups, and up to 200 birds may use a communal roost (Towry 1984). The predominant cover type is usually ponderosa pine, mixed conifer, or cottonwood. Cottonwoods are the preferred tree for roosting in Colorado. Locations protected from the wind by vegetation or terrain, provide a more favorable thermal environment. In addition to the natural features, roost sites are generally isolated from human disturbances.

Bald eagles use both prey and carrion food sources. Prey species frequently taken include fish, waterfowl, and small mammals such as muskrats, rabbits, and prairie dogs. Although bald eagles most frequently hunt from perches close to the water, they will range widely, up to 10 miles during daily hunting flights. During the winter, carrion becomes an increasingly larger component of the bald eagle's diet (Towry 1984).

Factors of Concern: A primary concern in potential nesting habitat will be removal of trees suitable for building nests. An additional concern for nesting and roosting habitat will be human disturbance, since bald eagles can be exceptionally sensitive around roosting and nesting sites (Towry 1984).

Affected Environment

The Project Area provides fall and wintering habitat for bald eagles. No nests or breeding activity has been documented in the Project Area. A large portion of winter concentration habitat for bald eagle is associated with river systems located on private lands across the western portion of the Project Area. Winter range in general is present across the Project Area involving all ownerships.

Removal of trees suitable for roosts and nests and human disturbance around nest and roost sites are potential impacts. The removal of potential roost and nest trees has not, however, been documented as a specific CBM-related effect to bald eagles in the Project Area. A total of 34 existing wells are located within winter concentration areas defined by CDOW in the Project Area: 29 on private lands, three on state lands, and one each on BLM and National Forest System Lands. These wells have caused direct disturbance of 59 acres, or 0.5 percent, of the delineated winter concentration areas. Although it has not been specifically documented, the location of existing CBM facilities in relation to defined bald eagle ranges suggests that human disturbance to winter concentration areas may have occurred. A total of 9,617 acres of winter concentration areas (or 83 percent of the total) are within 1 mile of an existing CBM facility in the Project Area. The magnitude of this impact to wintering bald eagles is difficult to estimate because they tend to be less sensitive to disturbance during the winter and can become accustomed to regular disturbance (for example, from compressor noise and daily visits to wells).

Other activities that have occurred in the Project Area also likely have had direct and indirect effects on bald eagles. These other activities include agriculture, residential and commercial development, road construction, timber harvest, and mining. Each of the four major drainages in the Project Area has been subject to substantial residential and agricultural development. The effects of these developments are not quantifiable, but they have likely reduced the suitability of these areas for nesting, foraging, and wintering bald eagles.

Effects of the Proposed Action

Factors of concern for the proposed action include potential for injury or mortality, loss and degradation of habitats for eagle and prey species, and disturbance resulting from human activity. Each of these concerns and potential effects are discussed below.

Injury or Mortality: Injury or mortality of bald eagles through several different mechanisms have been considered, including project activities, poaching, collision with power lines and vehicles, and electrocution on power lines. Construction will not cause direct injury or mortality to bald eagles because eagles will likely avoid construction zones and activities. Committed conservation measures for eagle are designed to minimize any potential injury or mortality resulting from project activities.

Intentional or unintentional shooting, poisoning, or trappings are sources of injury or mortality to eagles. There is the potential that these sources of injury or mortality could occur because of greater exposure of bald eagles to a higher level of human presence within and adjacent to winter concentration areas where most eagles are occupying during winter. It is difficult to predict the extent and likelihood of these occurrences. The U.S. Department of Agriculture, Animal and Plant Health Inspection service (APHIS), Wildlife Services Program, conducts depredation control measures targeting primarily coyotes, and to a lesser extent other mammals, in the Project Area. The use of poisons is not permitted on Public Lands as outlined in the Forest Plan and Resource Management Area Plans for the San Juan Public Lands. Colorado state laws and regulations limit and restrict the amount, and type of trapping occurring on private and public lands. Consequently, we do not expect adverse impacts to eagles from poisoning or trapping activities. Intentional and unintentional shooting occurrences are more difficult to predict and we are currently unaware of these actions.

Construction of aboveground power lines could result in collisions or electrocutions, causing injury or mortality to the bald eagle. Several specific measures have been included as part of the proposed action to minimize the potential for collision or electrocution: (1) burial of utility lines, if possible; (2) avoidance of areas where raptors may frequently hunt (for example, wetlands), and (3) application of Avian Powerline Interaction Committee (APLIC) standards (APLIC 1994 and 1996) to line spacing, conductor layout, and utility pole construction.

Bald eagles could experience injury or mortality because of collisions with vehicles. Although the current number of bald eagle collisions with vehicles in the Project Area is unknown, it is recognized that they could occur due to the expected growth in traffic volumes and daily trips into the Project Areas via the use of State, County, BLM and FS roads. Current traffic volumes are low to moderate for many travel routes in the Project Area. Traffic volumes on U.S. Highway 160 largely depend on the season, but regardless, receive the highest use in the Project Area. Under the proposed action, traffic volumes are expected to be moderate to high during the construction phase, and then reverting back close to current levels during the production and abandonment phases, generally low and moderate levels. This additional traffic could result in increased roadkill and roadside carrion particularly along U.S. Highway 160 and area County Roads where speed levels are higher than gravel roads on public lands. Increased use on U.S. Highway 160 and area County Roads could result in more roadkill mule deer and elk, potentially attracting more eagles to feed on roadside carrion since the animals are typically removed off the shoulders of roads. Given that most of the roads utilized for the proposed action are not expected to have excessive speed levels associated with them, the probability of eagle-vehicle collisions is low.

Habitat Loss and Degradation: Bald eagle habitats will be directly disturbed by project activities, and additional habitat may be degraded. Direct physical disturbance to bald eagle habitat will be caused by construction of roads, well pads, and compressors. Sixteen well pads, one compressor, and 4.5 miles of road will be constructed in bald eagle winter concentration areas. The facilities will disturb 48 acres, or 0.4 percent, of winter concentration areas in the Project Area. Of the 48 total acres being disturbed, 10

acres are on National Forest System Lands, three each on BLM and State lands, and 31 acres on private lands.

Project activities could degrade terrestrial and aquatic habitats that support typical prey for bald eagle. Degradation of surface water quality by sediment or accidental spills could reduce aquatic prey base such as fish. Increased sediment into aquatic systems has the potential to affect spawning habitat and increase water temperatures affecting cold-water fish survival. Accidental spills could release toxic chemicals also resulting in direct mortality. The probability of increased mortality from these sources is likely to be small on an annual basis. The application of BMPs and other committed conservation measures will minimize degradation of surface water quality.

There are approximately 281 acres of active Gunnison's prairie dog colonies in the Project Area. Three colonies are on private land, and two colonies are on State land. The proposed action does not propose any new development on or immediately adjacent to these colonies. Some existing development is located near four of the colonies. Potential impacts to prairie dogs in the area are expected to be low, and consequently the potential effects to prairie dog as a prey source to bald eagle are also expected to be low since wintering eagles are thought to prey primarily on fish in the major rivers, and carrion found across the Project Area. Additionally, prairie dog activity during winter is low as individuals spend more time underground as opposed to spring and summer when they are most active. If there were eagles nesting in the Project Area, prairie dogs would become more valuable as prey during the breeding and post fledging period. Prairie dog colonies present in the Project Area are likely not critical prey areas for eagles nesting outside the Project Area because they are at least 10 miles away, and prairie dog colonies found closer to known nests provide a food source for them.

The distribution and occurrence of prey species such as fish, and carrion from mule deer and elk, for bald eagle are not likely to experience effects at a scale sufficient to reduce their overall availability. Through the application of BMPs and committed watershed conservation measures, potential effects to terrestrial and aquatic foraging habitats should not result in detrimental changes to individual condition, or use of the Project Area and Northern San Juan Basin by wintering bald eagle populations. Fragmentation of habitat associated with the proposed action should not limit movement of the bald eagle or isolate habitat patches that are used by foraging bald eagles, but there could be minor shifts in distribution within the Project Area.

Human Disturbance: Project activities have the potential to disturb bald eagles. These activities include new surface disturbance associated with facility construction, production, and abandonment. Winter roosting eagles can exhibit heightened sensitivities to human disturbance, although foraging eagles are relatively less sensitive to many human disturbances. Approximately 9,240 acres of bald eagle winter concentration areas (or about 80 percent of the area available) are located within 1 mile of proposed project facilities (the total presented previously for existing facilities is slightly higher.) Committed conservation measures are designed to minimize disturbance to bald eagles in winter concentration areas. Construction will not occur during the period of November 15 and March 15 in winter concentration areas.

Additionally, construction activities will not occur during the period of December 1 to May 31 on SJNF lands and December 1 to April 30 on BLM lands across the Project Area in key big game winter range or winter concentration areas.

The potential for bald eagles to be disturbed across the Project Area is expected, but the level of disturbance is expected to be low since most bald eagle use occurs within identified bald eagle winter concentration areas, and proposed action activities are widely distributed across the Project Area.

The relatively widespread distribution of foraging habitats in the Project Area and widespread nature of human activity are not expected to cause detrimental changes to the bald eagle's foraging patterns. Most human activity will occur during construction of project facilities, and then diminish during the operation and abandonment phases. Human activities will be the lowest during the production phase and can be characterized as regular and low intensity. During abandonment, local levels of activity will temporarily increase for a period sufficient to complete habitat restoration.

Cumulative Effects

The cumulative effects analysis area for the bald eagle is defined as the Project Area and the portion of the Southern Ute Indian Reservation within the study area for oil and gas development on the Southern Ute Indian Reservation EIS (U.S. Bureau of Land Management et al. 2002). The study area encompasses 421,300 acres; therefore, the cumulative effects analysis area is 546,648 acres. Within this area are three bald eagle nests and approximately 27,500 acres of bald eagle winter concentration areas (U.S. Bureau of Land Management et al. 2001).

The cumulative effect of the proposed action, combined with all other known existing and proposed oil and gas development will cause a total surface disturbance of 826 acres, or 3 percent of bald eagle winter concentration areas in the cumulative effects analysis area. Committed conservation measures are designed to minimize or prevent harassment or displacement of bald eagles in winter concentration areas. The proposed action will not increase the potential for impacts to nesting bald eagles because there are no bald eagle nests in the Project Area. In addition, mitigation measures have been developed that will prevent effects in the event that a bald eagle nest is established in the Project Area. The 243 acres of known winter roosting habitat east of the Project Area will not be impacted by the Proposed Action. Measures will be implemented to minimize or avoid impacts to any newly discovered winter roost areas as determined by surveys.

Other cumulative effects, although difficult to quantify, could be caused by activities on private lands, such as sand and gravel mining, ranching, agriculture, road construction, and rural and urban housing development.

The population of La Plata County grew by approximately 10,000 people in the last decade. This area accounts for the western portion of the Project Area and where most private lands in the cumulative effects analysis area occur. The population is projected to grow by an additional 20,000 people during the proposed implementation period for the project. Associated with this population growth is an increase in residential use on private lands. Approximately 86 percent of the bald eagle winter concentration areas in the Project Area are located on private lands, primarily along the river valleys where future development could be most intense. Traffic on area roads will also increase. Effects to bald eagles from these activities will be in addition to the cumulative effects that have been quantified.

Determination

Implementation of the proposed action **may affect but is not likely to adversely affect the bald eagle and bald eagle habitat in the Project Area**. The proposed action will disturb 48 acres, or 0.4 percent, of the winter concentration areas in the Project Area. Cumulatively, the proposed action when combined with other CBM related activities in the San Juan Basin will cause a total surface disturbance of 826 acres, or 3 percent of bald eagle winter concentration areas in the cumulative effects analysis area. Committed conservation measures are designed to avoid adverse effects to the bald eagle and bald eagle habitat.

Mexican Spotted Owl

Status: The FWS listed the Mexican spotted owl (MSO) as threatened in April 1993. This species is also listed as threatened by the State of Colorado. There is no designated critical habitat for the MSO in the Project Area (U.S. Fish and Wildlife Service 2001a).

Distribution: The MSO is geographically isolated from the Northern and California subspecies. It is distributed discontinuously throughout its range in disjunct localities that correspond to isolated mountain systems and canyons. In the United States, 91 percent of the MSOs known to exist between 1990 and 1993 occurred on lands administered by the USFS. Eighty-nine percent of the MSOs known to exist in Mexico between 1990 and 1993 were in the states of Sonora and Chihuahua (U.S. Fish and Wildlife Service 1995b).

The Mexican spotted owl inhabits diverse forest types scattered across an even more physically diverse landscape (U.S Fish and Wildlife Service 1995b). Throughout its range the MSO uses a variety of habitat types but tends to do so on a regional basis, consequently, one of the primary reasons for dividing the range of the subspecies into eleven separate Recovery Units (RUs) (6 in the U.S., 5 in Mexico) in the Recovery Plan for the Mexican Spotted Owl (U.S. Fish and Wildlife Service 1995b).

The SJNF and BLM lie within the Southern Rocky Mountains Colorado Recovery Unit, but borders the Colorado Plateau and Southern Rocky Mountain New Mexico Recovery Units. The following are general habitat descriptions for each of these RUs as presented in the Recovery Plan:

Southern Rocky Mountains Colorado Recovery Unit: This RU lies completely within Colorado, and extends from the New Mexico border, east to the Front Range and north to the Wyoming border, excluding the extreme southwestern and northwestern portions of the state. The RU lies at the northeastern periphery of MSO range. In this RU, MSO is found primarily in canyons, in which they appear to occupy two disparate canyon habitat types. The first is sheer slick-rock canyons containing widely scattered patches (up to 1 ha [2.2 ac.] in size) of mature Douglas-fir in or near the canyon bottoms or high on the canyon walls in short, hanging canyons. The second consist of steep canyons containing exposed bedrock cliffs either close to the canyon floor or more typically, several tiers of exposed rock at various heights on the canyon walls. Mature Douglas-fir, white fir, and ponderosa pine (often in association with Gambel oak) dominate the canyon bottoms on north and east-facing slopes, while ponderosa pine grows on the more xeric south and west-facing slopes with pinyon-juniper growing on the mesa tops.

In this RU, spotted owls are largely confined to steep canyons, generally with significant rock faces and various amounts of mature coniferous forest (Federal Register/Vol. 65, No. 141/Friday, July 21, 2000; Proposed Designation of Critical Habitat for the Mexican Spotted Owl). In Colorado, most MSOs are found in mixed conifer forests located within steep, rock-walled canyons with pinyon-juniper and ponderosa pine forests near the canyons (pers.com. Richard Reynolds and William Block 2003).

Southern Rocky Mountains New Mexico Recovery Unit: This RU is located in north-central New Mexico extending northward to the Colorado border and southward to the Jemez Mountains. In this RU MSO generally occupies steep terrain and canyons. They typically inhabit mixed-conifer forests on steep slopes in the Sangre de Cristo range, and canyons incised into volcanic rock in the Jemez Mountains.

Although the SJNF and BLM may contain some suitable habitat, surveys conducted to date across public lands revealed no detections of MSOs (observations or responses). Near the Project Area, the MSO is found in mixed conifer forests of extreme southwest Colorado in rock-walled canyon habitat of Mesa Verde National Park approximately 30 miles west of the Project Area, the mountains of northern New Mexico, and the central Front Range of Colorado. MSOs have also been identified on the Jicarilla Ranger District of the Carson National Forest in New Mexico, directly south of the Project Area (pers. com. Camela Hooley 2003). The Jicarilla Ranger District lies southeast of the Project Area, approximately 17 air miles.

On June 6, 1995 the FWS published a final rule designating critical habitat for MSO (U.S. Fish and Wildlife Service 2000b). This ruling resulted in three Critical Habitat Units (CHUs) on the SJNF. Two of these Units CO-SJNF-1 and CO-SJNF-2 were located in the Project Area. The first CHU encompassed the Ignacio Creek/Canyon and Spring Creek Areas. The second CHU encompassed the Deep Canyon Area. As a result of a court ruling, the FWS removed several CHU designations including the two within the Project Area on March 25, 1998.

Currently, there is no critical habitat designated in the Project Area or on the SJNF (U.S. Fish and Wildlife Service 2000b). Critical habitat has been proposed elsewhere within the Southern Rocky Mountains Colorado Recovery Unit.

MSO survey results within the Project Area

The following describes the results of MSO surveys within and adjacent to the Project Area. All surveys conducted were performed using accepted MSO Survey Protocols. Survey results across the Southern Rocky Mountains Colorado Recovery Unit are not provided because they are not relevant to this analysis. Survey results and description of habitats present in the Project Area help determine potential effects to MSO from the proposed action.

1989 Surveys: Reynolds (1989) surveyed 358 miles of transect in Colorado for spotted owls in 1989. Six spotted owls were located (responses heard): one associated with steep slope mixed conifer forest, one associated with steep slope montane and pinyon-juniper forests, two associated with steep-walled canyon montane and pinyon-juniper forests, and one associated with steep-walled canyon Douglas fir and pinyon-juniper forests. One of these locations was in Sandoval Canyon (steep slope montane and pinyon-juniper forests) approximately 6 miles south of the Project Area.

In 1989, the SJNF contracted MSO surveys in areas thought to provide suitable habitat. Surveys were conducted in Ignacio Creek/Canyon, Turkey Creek, and Bull Creek/Canyon. No MSOs were detected (Wagner 1998). The upper portion of Ignacio Creek/Canyon contains several steep intermittent drainages with some areas of exposed rock (Black and Wood 2003). Cliffs are present, but no cliffs are over approximately 30 ft. high (Black and Wood 2003). Vegetation within the upper portion of Ignacio Creek/Canyon is comprised of mature mixed conifer and ponderosa pine forests. This area provides approximately 2,000 acres of suitable habitat for MSO (U.S Forest Service 1995). The 1995 suitable habitat boundary has been transferred into the SJNF Geographic Information System (GIS) using the same topographic features to delineate the boundary identified in the 1995 mapping effort. The new GIS version of this boundary now comprises approximately 1,980 acres. This areas suitability as habitat for MSO is likely marginal given the limited rock-walled and/or exposed rock structure present that provide nesting habitat for MSOs elsewhere in Colorado.

Vegetation in the lower portion of Ignacio Creek/Canyon consists of pinyon-juniper on south facing slopes, and mature ponderosa pine and mixed conifer further up the drainage. There are no cliffs, rock-

walled canyons, or rock outcrops at the lower and mid portions of the drainage, but there are some moderately steep slopes present. If there were MSOs at the upper end of the drainage, it is likely owls would use the lower and mid portion of the drainage for foraging or dispersal, along with forested areas associated with mesas above and/or outside the canyon.

Vegetation in Turkey Creek consists of a minor component of pinyon-juniper found at the lower portion of the drainage on south-facing slopes, and some mature ponderosa pine at the lower, mid, and upper portions of the drainage. There are no cliffs, rock-walled canyons, or rock outcrops in the drainage, but there are moderately steep slopes present. This area does not provide suitable habitat for MSO due to the absence of rock-walled canyon structure.

Vegetation in Bull Creek/Canyon consists of a minor component of pinyon-juniper found at the lower portion of the drainage on south-facing slopes, and mature ponderosa pine and mixed conifer found in the lower, mid, and upper portions of the drainage. There are no cliffs, or rock-walled canyons in the drainage. Rock outcrops are limited, and there are moderately steep slopes present. This area does not provide suitable habitat for MSO due to the absence of rock-walled canyon structure.

In all locations, Gambel oak is a significant component in the understory.

1990-1992 Surveys: In 1990, 1991, and 1992, the SJNF contracted more surveys for MSO in the HD Mountains in areas thought to provide suitable habitat, but no MSOs were detected (U.S. Forest Service 1992). According to the results, the HD Mountains were not considered occupied by individuals or pairs of spotted owls, although local habitats appeared to be suitable (U.S. Forest Service 1992).

Ignacio Creek/Canyon was surveyed again in 1991 and 1992. In 1991 and 1992 Deep Canyon was surveyed. Deep Canyon contains vegetation similar to Turkey Creek and Bull Creek/Canyon. There are no cliffs, or rock-walled canyons in the drainage, but there are some rock outcrops, and steep slopes present. The portion of Deep Canyon on SJNF lands does not provide suitable habitat for MSO due to the absence of rock-walled canyon structure, however, there appears to be suitable habitat on adjacent Southern Ute Indian Reservation lands (U.S Forest Service 1995).

1990-1994 Surveys: MSO surveys were regularly conducted from 1990 through 1994 across the SJNF in areas thought to provide suitable habitat for MSO, but there were no detections (U.S. Forest Service 1994).

1996 Surveys: In 1996, there were two reports of an individual MSO in the Fosset Gulch and Bull Creek/Canyon areas. These reports were from two different periods, and came from certified MSO surveyors who heard an MSO while doing stand exam surveys and wildland firefighting (pers. com. Barry Rhea and Scott Wagner 2003). The first report is from July 1996. The response was heard in ponderosa pine and mixed conifer habitat at approximately 8,000 feet elevation on a northeast aspect. The second report is from August 1996 approximately one mile south of the July 1996 report. Two nighttime surveys were conducted in August 1996 in the area to try and locate the individual, but no owls were detected. The owl heard was probably a transient passing through looking for suitable habitat (Wagner 1998).

1997 and 1998 Surveys: Surveys were conducted again in 1997 and 1998 within the Project Area. No MSOs were detected. Routes surveyed in 1997 included: Fosset Gulch, Bull Creek/Canyon, Little Bull Creek/Canyon (within the Bull Creek/Canyon drainage), and Turkey Creek. Vegetation in Fosset Gulch consists primarily of mature ponderosa pine with Gambel oak in the understory. Mature mixed conifer is present on northerly aspects. There are no cliffs, or rock-walled canyons in the drainage. There are moderately steep slopes present, and rock outcrops are limited. Fosset Gulch does not provide suitable habitat for MSO due to the absence of rock-walled canyon structure.

Routes surveyed in 1998 included Turkey Creek, Bull Creek/Canyon, and Little Bull Creek/Canyon.

2002 and 2003 Surveys: The 2002 and 2003 survey routes covered approximately 17.5 miles and 10,535 acres. No MSOs were detected (observations or responses). Areas surveyed included: Ignacio Creek/Canyon, Bull Creek/Canyon, Little Bull Creek/Canyon, Fosset Gulch, lower Little Squaw Creek, Deep Creek, and Spring Creek (See Map Provided).

Vegetation in Ignacio Creek/Canyon, Bull Creek/Canyon, Little Bull Creek/Canyon, Fosset Gulch, and Deep Creek is described above. Vegetation in lower Squaw Creek is similar to that present in Fosset Gulch. There are no cliffs, or rock-walled canyons in the drainage. Rock outcrops are limited, and moderately steep slopes are present. Lower Squaw Creek does not provide suitable habitat for MSO due to the absence of rock-walled canyon structure.

Vegetation in Spring Creek consists predominately of pinyon-juniper found in the lower elevations, some mature mixed conifer on northerly aspects, mature ponderosa pine/Gambel oak, and large continuous stands of Gambel oak. There are no cliffs, or rock-walled canyons in the drainage, and rock outcrops are limited. The area does contain moderately steep slopes. Spring Creek does not provide suitable habitat for MSO due to the absence of rock-walled canyon structure.

Survey Results Conclusion: The results of surveys conducted in 1989, 1990, 1991, 1992, 1996, 1997, 1998, 2002, and 2003 within what appeared to be potential or suitable habitat for MSO revealed no detections (observations or responses). Results from surveys have helped define suitable habitat in the Project Area. For the analysis of effects discussion, suitable habitat is considered as pinyon-juniper, ponderosa pine, and mixed conifer vegetation located within or associated with rock-walled canyons, exposed cliffs, or rock outcrops. This definition of suitable habitat is consistent with habitat described above for the Southern Rocky Mountains Colorado Recovery Unit where MSOs have been detected. Based on the results of field reconnaissance and surveys that have taken place, the upper portion of Ignacio Creek/Canyon is the only area in the Project Area providing marginally suitable habitat (approximately 1,980 acres) for MSO. This areas suitability is considered marginal because of the limited rock-walled and/or exposed rock structure present that provides nesting habitat.

Life History: MSOs nest, roost, forage, and disperse in a diverse array of biotic communities. Mixed conifer forests are commonly used throughout most of their range. Douglas-fir and white fir dominate these forests, with co-dominant species including southwestern white pine, limber pine, and ponderosa pine. The understory often contains these species, as well as broad-leaved species such as Gambel oak, maple, box elder, and New Mexico locust (U.S. Fish and Wildlife Service 1995b).

MSOs typically locate prey from an elevated perch by sight or sound, then pounce and capture it with their talons. They have also been observed capturing birds in flight. They hunt primarily at night. MSOs consume a variety of prey throughout their range, and diet varies by geographic location. They typically prey on small- and medium-sized rodents such as wood rats, peromyscid mice, and microtine voles; however, they also consume bats, birds, reptiles, and arthropods. Managing habitat for a diversity of prey species may help buffer against fluctuations in population of individual prey species and provide a more constant supply of food for the MSO (U.S. Fish and Wildlife Service 1995b).

Predation, particularly by avian predators, may be a common mortality factor for MSO. Potential avian predators include great horned owls, northern goshawks, red-tailed hawks, and golden eagles. Some of these predators occupy the same general habitats as MSO, but there is little direct evidence that they prey on MSOs. Starvation is another likely cause of mortality (U.S. Fish and Wildlife Service 1995b).

Factors of Concern: A key factor of concern for MSO is the loss of mature and old-growth mixed conifer habitats where they occur in steep, rock-walled canyons. The threat of catastrophic wildfire and subsequent loss of habitats for the MSO and its prey species are also a major concern. Alteration of stand structure, such that they become less suitable for prey species or more suitable for predators and competitors, is also of concern.

Affected Environment

Marginally suitable habitat for MSO is present on National Forest System Lands present in the eastern portion of the Project Area in Ignacio Creek/Canyon (See Map Provided). Vegetation comprising the 1,980 acres of marginally suitable habitat consists of 107 acres of pole-size and mature aspen, 171 acres of Gambel oak, 50 acres of grass-forbs, 435 acres of pole-size and mature mixed conifer, 101 acres of old growth ponderosa pine, 871 acres of mature ponderosa pine, and 245 acres of pole-size and mature pinyon-juniper forests. Past and current land use activities potentially influencing MSO and MSO habitat are therefore limited to those actions administered by the SJNF. The following is a summary of activities occurring on SJNF lands in the Project Area, and their potential influences to MSO.

Effects from CBM Development: The impact to mature and old-growth ponderosa pine and mixed conifer habitats in the previously mentioned surveyed areas, alteration of stand structure, and potential impact to prey species and habitats are all potential impacts to MSO. These impacts have not been documented as specific effects to MSO resulting from CBM development in the Project Area due to the limited amount of marginally suitable habitat present, and no owls have been detected.

Effects from Timber Harvest: Past timber harvest activity from the SJNF Activities Database indicates that from 1941 through 1996, a total of 6,871 acres were harvested on SJNF lands in the Project Area. Ponderosa Pine and Douglas-Fir were the main species harvested. Past timber harvest consisted of even-aged management (shelterwood cuts), sanitation salvage, commercial thinning, and pre-commercial thinning. Approximately 1,535 acres of Ponderosa Pine and Douglas-Fir were harvested that resulted in the conversion to these vegetation types (grass/forb 103 acres; unknown shrub 55 acres; sagebrush 237 acres; Gambel oak 895 acres; pinyon-juniper 214 acres; riparian 5 acres, non-forest 26 acres). Approximately 4,960 acres of the Ponderosa Pine type were harvested during this time period, with harvest altering the stand structure (removing of larger trees in the overstory, and smaller sawtimber trees in the understory). Approximately 376 acres of the Mixed Conifer type were harvested, with again only changes to stand structure within this vegetation type. Approximately 62 acres received mechanical fuels treatment, while 332 acres received site preparation for regeneration treatments, and 761 acres were planted. Potential impacts to MSO from past harvest have likely been insignificant due to the limited amount of suitable habitat, and no owls have been detected. Harvest activity on steep slopes was limited in most instances because of access and for various resource concerns. Harvest activity occurred primarily on more gentle slopes, and relatively flat mountain tops or mesas. These past activities have, however, influenced habitat for wildlife associated with ponderosa pine and mixed conifer forests addressed in the EIS and BE.

Effects from Wildland Fire Suppression: Wildland fire suppression has been the overriding strategy for dealing with all fires in the Project Area since settlement in the late 1800's. This strategy has resulted in a somewhat unnatural mix of vegetation both in structure and density. Certainly grazing during this period also resulted in fewer fires escaping control. The pinyon pine and juniper forests are very dense except on south facing slopes in the lower elevations where moisture limits growth. When this forest type becomes dense, the result is bare ground underneath, or very limited grass-forb production. Had fire played a natural role during the last century, many of these pinyon-juniper stands would have burned which would have produced a greater amount of desirable shrubs, grasses and forbs for wildlife.

The effect of fire suppression on Ponderosa pine is similar. There are many more small diameter trees present today than there would be had fire played a role in the last 100 years. This limits the moisture and sunlight available for grasses and forbs to grow such as those present in more open park-like stands.

Fire suppression is considered a key factor influencing MSO habitat across the species range (U.S. Fish and Wildlife Service 1995b). The build up of fuels within MSO forested habitat has influenced habitat by making it more vulnerable to stand-replacement fire which may lead to adverse impacts to the species. We recognize fire suppression as influencing the limited amount of suitable habitat for MSO in the Project Area, although resulting effects to the species are unknown since no owls have been detected.

Effects from Prescribed Fire: The history of prescribed fire in the Project Area is as follows: Sauls Creek, 1987 – 460 acres; 1992 – 215 acres; 2001 – 1,365 acres; Lange Canyon, 1988-89 – 1,430 acres; Spring Creek/Ignacio Canyon, 1992 – 3,331 acres. The primary objectives for these burns were to top kill Gambel oak, and minimize/reduce its presence as a ladder fuel while at the same time enhancing wildlife habitat. No significant changes in tree canopy closure or density occurred as a result of these burns.

One natural (lightning caused) fire was managed for resource benefits in 1997. The Turkey Creek Fire was 344 acres. It grew from a single tree to the final size when rain put it out. This fire top killed a lot of Gambel oak, resulting in prolific sprouting, and also killed some mid-size ponderosa pine which created snags for some bird species and opened up the forest canopy which improved the forage base for numerous species.

One wildfire that was the result of ditch burning on private lands spread onto SJNF lands in Green Canyon in 1968, and grew to several hundred acres. Because of the intensity developed as the fire moved upslope, virtually all of the trees were killed. Today the area is dominated by grasses, forbs, and Gambel oak in the understory.

A fuels reduction and wildlife habitat project was done on Raven Ridge (Spring Creek drainage) in 2000. Openings of approximately one-half acre were created over a 300 acre mesa to interrupt the continuity of the forest canopy and create opportunities for forage growth. A hydromower was used to thin trees and create openings. Elk and deer were the target species for this project.

We recognize prescribed fire activity has having beneficial effects to vegetation in the Project Area, benefiting numerous species of wildlife including potential MSO. These resulting beneficial effects to MSO are unknown since no owls have been detected in the area.

Effects from Livestock Grazing: The Project Area comprises all or portions of several active grazing allotments including: HD, Turkey, Sauls Creek, Bonnell Canyon, Beaver-Baldy, Little Bear, and Freeman Creek. The Project Area also includes two closed grazing allotments: Turkey Exclosure and Chimney Rock.

Public Lands within the Project Area were used yearlong due to the generally low elevation by cattle and sheep prior to the establishment of the Forest. After establishment, adjoining ranches continued their use with probably excessive numbers. Trespass was frequent, and forage depletion and accelerated erosion resulted from this misuse of the range. From the 1930's to present, conditions have continued to improve in terms of species composition and cover. Various management practices have been implemented such as elimination of season long grazing, creation of rotation grazing systems, fencing of allotments into pastures to control cattle distribution, developing stock ponds and erosion control structures in key watersheds, reseeding of depleted areas, and implementing prescribed burns to recycle nutrients.

Active allotments are currently managed with rotation grazing systems. Some allotments are used only 30 days in the spring and others are used the entire season with deferment of pastures during certain periods of the growing season. Stock ponds, herding, salting, fencing and geographical barriers are the primary means of controlling livestock distribution. Range analysis summaries show an upward trend in terms of species composition and cover.

We recognize livestock management as having effects to vegetation within the Project Area. These resulting effects to MSO are unknown since no owls have been detected in the area.

Effects of the Proposed Action

As mentioned previously, a key factor of concern for MSO is the loss of mature and old-growth mixed conifer habitats where they occur in steep, rock-walled canyons. The loss of habitat in a given area, or the alteration of stand structure could cause adverse impacts to MSO and prey species, and/or make habitat conditions more suitable for predators and competitors.

The combination of ponderosa pine and mixed conifer forests associated with steep, rock-walled canyons are limited to the upper portion of Ignacio Creek/Canyon. There will be no well, road, or pipeline activities in the steep canyons or near exposed rock cliffs associated with mature mixed conifer and ponderosa pine that comprise approximately 1,980 acres of marginally suitable habitat in Ignacio Creek/Canyon (See Map Provided).

There is activity proposed further down Ignacio Creek/Canyon that includes three wells, one in Section 18U, Section 19U, Section 30U, and a proposed directional drill well pad with well in Section 19U. Close to two and a half miles of access road/buried pipeline are associated with these wells. This activity will occur within marginally suitable habitat. This activity will disturb 16.2 acres of primarily mature ponderosa pine and Gambel oak vegetation (See Map Provided). Roads, pipelines, and wells are also proposed outside Ignacio Creek/Canyon on the mesas and mountain tops (See Map Provided).

Across the Project Area, the proposed action will affect 58 acres of mature mixed conifer habitats; however, there are no steep, rock-walled canyons near these areas.

MSOs may disperse through or forage in the Project Area, as evidenced by the 1996 reports in the Fosset Gulch area. MSOs are not likely to remain in the Project Area for any length of time because of the lack of suitable nesting habitat. There is potential for individual MSOs should they move into the area to be disturbed and possibly displaced by construction activities. The potential for this effect to occur is low as foraging or dispersal in the Project Area is probably rare, and small portions of the Project Area will be affected at any time during the construction phase. The disturbance to 16.2 acres within marginally suitable habitat is not expected to degrade the value of the approximate 1,980 acres of habitat in Ignacio Creek/Canyon. Should any nesting/breeding MSOs be discovered in the Project Area, guidelines described in the Recovery Plan will be implemented to protect nesting and foraging habitats, and reduce disturbance impacts during the breeding season.

Cumulative Effects

The cumulative effects analysis area for the MSO is defined as the Project Area and that portion of the Southern Ute Indian Reservation within the study area for the oil and gas development on the Southern Ute Indian Reservation EIS. The study area encompasses 421,300 acres; therefore, the cumulative effects analysis area is 546,648 acres. Within this area are approximately 56,000 acres of mixed conifer and ponderosa pine that may provide foraging opportunities for the MSO (BLM et al. 2002). Approximately 1,559 acres, or 2.8 percent, of these areas will be lost to oil and gas development on a cumulative basis.

The loss of habitat predicted is unlikely to adversely affect the MSO, particularly considering that this species rarely, if ever, uses the area for foraging and dispersal. Other cumulative effects, although difficult to quantify, could be caused by activities on private lands. These other activities include sand and gravel mining, ranching, agriculture, road construction, and rural and urban housing development. Most of this type of development has not occurred, and likely not occur, in potential foraging or nesting habitat for MSO. Dispersal of MSOs across the landscape is not expected to be affected given since no MSOs are known to be present in the area.

Prescribed fire and fuels projects administered by public land resource specialists and their cooperators, as well as fire suppression will continue into the future. Along the private land boundaries on the outer edges of the H.D. Mountains, the priority will be to protect private lands, subdivisions and communities from fire. This is the zone where fires will be suppressed and mechanical fuels projects will be used. Immediately outside the interface, prescribed fire will be used to replicate a natural fire regime in the Ponderosa pine type. The management objective will be to keep natural fuels at more manageable levels, while providing resource benefits, and allowing management of natural fires to be less impacting to the resource. An emphasis area has been designated in the core area of the H.D. Mountains for allowing natural fire to play its role. There will be limitations such as fuel conditions, drought, resource availability, and others variables, and the intent is to allow natural fire to meet resource goals and objectives. Having a natural fire regime in the H.D. Mountains that perpetuates natural vegetation communities and protects against catastrophic wildfire will be a benefit to most wildlife species including MSO

Determination

Implementation of the proposed action **may affect, but is not likely to adversely affect the Mexican spotted owl, and marginally suitable habitat.** This determination is based on the results of surveys in areas of potentially suitable habitat, and the lack of any detections within the Project Area. There has been no critical habitat identified in the Project Area or the SJNF and BLM. The impact of 16.2 acres of marginally suitable habitat is not expected to degrade the value of the approximate 1,980 acres of habitat in Ignacio Creek/Canyon. Cumulatively, the proposed action will not result in any adverse impacts to MSO habitat present elsewhere in the San Juan Basin, or affect populations that may exist elsewhere in the Basin or in Northern New Mexico.

Southwestern Willow Flycatcher

Status: The FWS listed the southwestern willow flycatcher (SWWF) as endangered in February 1995 (U.S. Fish and Wildlife Service 1995c). This species is also listed as endangered by the State of Colorado. Critical habitat for the SWWF has been designated; however, none is in the State of Colorado (U.S. Fish and Wildlife Service 1997).

Distribution: SWWFs are neotropical migrants, but their migration routes and winter ranges are not well known. They are generally thought to winter in Mexico, Central America, and perhaps in northern South America. The Project Area is within the Upper Colorado River Recovery Unit (U.S. Fish and Wildlife Service 2001b). Surveys were initiated on the SJNF and BLM during 1994 and 1995 and are continuing annually in selected areas. A total of 106 acres of suitable habitat and five to six individuals (in two locations) have been identified on the SJNF by these surveys. No nesting sites have been identified within the Project Area. An individual was present at a site northwest of Bayfield near the Pine River throughout the breeding season in 1999 within the Project Area. In addition, surveys identified an individual at a site outside the Project Area near Ignacio in 2001during the third survey period.

A survey of potential SWWF habitat in the Project Area was conducted by Greystone Environmental Consultants, Inc., in July 2001. A total of 457 acres of suitable habitat and 67 acres of potential habitat were identified (See Map Provided). Most patches were associated with the large riparian ecosystems along the Animas, Florida, Pine, and Piedra Rivers associated with private lands, although some patches were also found along smaller drainages.

The Project Area is located in the Upper Colorado River Recovery Unit (U.S. Fish and Wildlife Service 2003b).

Life History: The SWWF arrives on its breeding grounds as early as mid-May and may be present until mid-August. They breed in riparian habitats along rivers, streams, or other wetlands, where dense stands of willows (*Salix* spp.) and other shrubs are present. A scattered overstory of cottonwood (*Populus* spp.) is also a common component of typical occupied habitat (Tibbitts et al. 1994). At this time there is no elevational limit for breeding habitat. This flycatcher is known to nest in thickets dominated by tamarisk (*Tamarix* spp.) and Russian olive (*Elaeagnus angustifolia*), but typically prefers native plant communities (Tibbitts et al. 1994). Preferred thickets or shrubs are 13 to 23 feet in height, with dense foliage up to 13 feet above ground, and often exhibit a high percentage of canopy cover. Vegetation at the nest site may be of even or uneven age, but is usually dense and structurally homogenous (U.S. Fish and Wildlife Service 1995c).

The minimum patch size that is required to support a nesting pair in willow riparian habitat is at least 30 feet long, 30 feet wide, with an average height of 5 feet (U.S. Fish and Wildlife Service 2003b). The available information indicates that habitat patches as small as 1.23 acres can support one or two nesting pairs (Tibbitts et al. 1994). Surface water or saturated soil is virtually always present in or adjacent to nesting thickets. Stream gradient may be also an important determinant in the suitability of habitat. No nest sites have been found along streams of steep gradient (greater than 4 percent) that are characterized by almost continuous riffles, rapids, falls, or other cataracts. The flycatcher may avoid these areas because higher-gradient streams tend to form more narrow riparian corridors or are confined within narrow scoured canyons. These riparian areas may be too narrow to constitute suitable habitat.

SWWFs build nests and lay eggs in late May and early June (incubation is approximately 12 days) and fledge young in late June or early July. Some variations observed may be related to altitude, latitude, and re-nesting attempts (Tibbitts et al. 1994). This species is threatened by brood parasitism from the brown-headed cowbird and perhaps increasingly by the bronzed cowbird (U.S. Fish and Wildlife Service 1995c).

Factors of Concern: A key factor of concern for this species is loss of riparian nesting habitat. Loss of habitat can occur because of conversion to other land cover types (for example, agriculture), excessive livestock grazing, or alteration of hydrological factors that support riparian vegetation. Additional concerns include disturbance near nesting habitat during the breeding season, loss of wintering habitat in Central and South America, and brood parasitism by cowbirds.

Affected Environment

Across the Project Area, SWWF habitat is located primarily on private lands associated with the major river systems described above. Loss of riparian nesting habitat, alteration of hydrological regimes, and human disturbance in nesting habitat are potential impacts related to CBM. One existing well in the Project Area is located on private lands in suitable SWWF habitat. This well has resulted in direct loss of 2 acres, or 0.4 percent, of suitable habitat. Although it has not been specifically documented, the location of existing CBM facilities in relation to suitable habitat suggests that human disturbance to nesting SWWFs may have occurred. A total of 140 acres, or 27 percent, of suitable SWWF habitat in the Project Area is within ¼ mile of existing CBM facilities.

Existing CBM development has depleted 65 acre-feet per year (0.09 cubic feet per second [cfs]) from the Animas, Florida, and Pine watersheds (Cox et al. 2001). Existing CBM development has not likely had any noticeable effect on flows in these three rivers because the depletions are several orders of magnitude smaller than mean flows. Mean flows for these rivers at the nearest available gauging stations are 832 cfs for the Animas, 39 cfs for the Pine, and 359 cfs for the Pine. In addition, the depletions are inconsequential compared with daily, monthly, and annual fluctuations caused by natural and artificial factors such as weather, dam releases, and irrigation water withdrawals. Alteration of hydrological regimes caused by CBM-related depletion of surface water is not known to have affected ecological conditions that support habitats for SWWF in the Project Area.

Other activities in the Project Area, such as agriculture, residential and commercial development, and road construction, have also likely had direct and indirect effects on SWWFs. Each of the four major drainages in the Project Area has been subject to substantial residential and agricultural development. The effects of these developments on SWWFs are not known. However, they have likely caused direct loss and degradation of suitable habitats and indirectly decreased the suitability of these habitats. The extent of these impacts and their effects on the SWWF population in the Project Area are not known because of a lack of data on the historical distribution of suitable habitats and historical and current populations of the SWWF in the Project Area.

Effects of the Proposed Action

Factors of concern for the proposed action include potential for injury or mortality, loss and degradation of habitats, and disturbance resulting from human activity. Each of these concerns and potential effects are discussed below.

Injury or Mortality: Surface disturbance associated with construction, operation, and abandonment of facilities, including roads, could result in direct mortality of juvenile and nestling SWWFs. This effect will not occur, however, because there are no known nest sites in the Project Area, and project activities will avoid any nest sites that are subsequently discovered (see committed conservation measures).

Collisions with vehicles are another potential source of injury or mortality. Project activities will increase vehicle traffic near habitats for SWWF. The potential for collisions associated with this project is expected to be low however, because of the current and expected low population density of SWWFs in the Project Area.

Habitat Loss and Degradation: No habitats for the SWWF will be disturbed by the proposed action. One well on private lands will be constructed near suitable habitat, and an access road will be built to this well. These activities will avoid any direct effects based on application of committed conservation measures.

Fragmentation of forested riparian habitats has been associated with increased nest parasitism of neotropical migratory birds by the brown-headed cowbird (Robinson et al. 1993). Although SWWF habitats in the Project Area are found within a fragmented mosaic of riparian areas, the project will not cause additional fragmentation of suitable habitats because there will be no new disturbance. The availability of perch sites in and adjacent to habitat has also been implicated in cowbird parasitism of SWWFs (Uyehara et al. 2000). Numerous trees, shrubs, fences, utility lines, and other components of the habitat are already available as perch sites for brown-headed cowbirds. Therefore, although project facilities may create additional perches, they are not likely to increase perch use or nest parasitism of SWWFs by cowbirds. Parasitism of SWWFs by brown-headed cowbirds has not been documented in the Project Area.

Human Disturbance: SWWFs may be displaced from habitats in areas of human activity. The extent of displacement will depend on the spatial and temporal scale of the activity and on the response of individuals to each type of disturbance. Approximately 113 acres, or 22 percent, of SWWF habitats are within ¼ mile of proposed CBM development. Displacement can have detrimental effects on breeding SWWFs by causing nest failure or facilitating nest parasitism; however, there are no known nests in the Project Area. Committed conservation measures will minimize the potential for disturbance in occupied habitat by avoiding the construction of facilities and associated activities within 100 meters of occupied habitat.

Cumulative Effects

The cumulative effects analysis area for the SWWF is defined as the Project Area and that portion of the Southern Ute Indian Reservation within the study area for the oil and gas development on the Southern Ute Indian Reservation EIS, as mentioned previously. The proposed action will avoid any new effects to SWWFs or their habitats in the Project Area through committed conservation measures that will prevent disturbance of habitats and restrict project activities from occurring in occupied habitats and during the breeding season. The SUIT EIS predicts that a maximum of 5.9 percent of the wooded riparian areas in the study area will be disturbed (BLM et al. 2002). The impact of this disturbance on SWWF habitat is unclear because these areas were not examined to assess their suitability for use by SWWFs. Mitigation measures in the SUIT EIS restrict surface-disturbing activities during the breeding season if any SWWFs are located and will therefore minimize disturbance of SWWF habitat. Therefore, the primary impact to SWWFs from oil and gas development in the cumulative effects analysis area will be any loss of habitat that cannot be avoided in the SUIT EIS Study Area. The extent of the impact is not currently quantifiable, but is expected to be a small portion of the available habitats.

Other cumulative effects, although difficult to quantify, could be caused by activities on private lands, such as sand and gravel mining, livestock grazing, agriculture, road construction, and rural and urban housing development. In the past, these activities have likely caused degradation or loss of substantial amounts of SWWF habitats (Marshall and Stoleson 2000) although no specific data are available for the cumulative effects analysis area. Considering the anticipated growth patterns, these activities are expected to continue into the future and may affect SWWFs because most of their habitats are on private lands, where there is little regulatory control.

Determination

Implementation of the proposed action **may affect, but is not likely to adversely affect the southwestern willow flycatcher and flycatcher habitat**. Suitable habitat will not be impacted by the proposed action, and committed conservation measures are designed to reduce impacts to suitable habitat, and occupied habitat.

Colorado Pikeminnow and Razorback Sucker

The discussion for these two species has been combined because of the similarity between the Affected Environments, effects of the proposed action, and mitigation measures for both species.

Status: The Colorado pikeminnow (*Ptychocheilus lucius*) and the razorback sucker (*Xyrauchen texanus*) are federally listed as endangered. They are both classified as threatened by the State of Colorado. The FWS has designated the San Juan River, from Farmington, New Mexico, downstream to Lake Powell, as critical habitat for the Colorado pikeminnow and razorback sucker (U.S. Fish and Wildlife Service 1994a).

Distribution: Historically, the Colorado pikeminnow was found in the warm water reaches of the Colorado River basin, including the upper Colorado River, Green River, and Gila River. Based on recent collections, the adult population of Colorado pikeminnow in the San Juan River is likely fewer than 100 individuals, and may be fewer than 50 individuals (Holden 1999). The closest occupied habitat to the Project Area is near Shiprock, New Mexico, approximately 90 miles downstream (U.S. Fish and Wildlife Service 1995a).

The razorback sucker was once widespread throughout most of the Colorado River Basin from Wyoming to Mexico. In the San Juan River drainage, historical accounts report individuals ascending the Animas River to Durango, Colorado, at the turn of the last century (Platania and Young 1989). This species is also found in the lower San Juan River basin, to which the Piedra, Pine, and Florida Rivers are tributaries. During a study conducted from 1987 through 1990, adults were collected in the San Juan arm of Lake Powell. A single male was found near Bluff, Utah (U.S. Fish and Wildlife service 1995a), 160 miles downstream of the Project Area.

The Colorado pikeminnow and razorback sucker do not occur within the Project Area. They may, however, be affected by water depletions or changes in water quality associated with the proposed action.

Life History: The Colorado pikeminnow is the largest cyprinid (minnow) fish in North America. Historical records indicate individuals as long as 6 feet and weighing up to 100 pounds. Ages of the larger fish were estimated at 25 to 50 years (Behnke and Benson 1983). This species evolved as the main aquatic predator in the Colorado River system. The diet of individuals longer than 3 or 4 inches consists almost entirely of other fishes (Vanicek and Kramer 1969). Large adults feed primarily on fish but are opportunistic and have been known to take carcasses of small animals and birds (Behnke and Benson 1983). Juveniles feed on small invertebrates (Behnke and Benson 1983). Adult Colorado pikeminnow prefer the deeper areas of river channels, while first-year fish inhabit quiet backwater areas and side channels (Woodling 1985).

Spawning typically occurs from early July to early September, but is highly dependent on the annual flow pattern as it relates to water temperatures. Spawning takes place in water temperatures between 68°F and 72°F (Woodling 1985). During low-flow years, these temperatures may be attained early, triggering early spawning activity; in high-flow years, spawning may be delayed. The pikeminnow is known to migrate long distances, probably in relation to spawning. One study showed an individual's movement of almost 200 miles upstream during a 4-month period. However, other studies found a typical range of roughly 25 to 30 miles during April through September (Miller et al. 1982). Larvae are thought to drift downstream after they hatch and inhabit natural backwaters with no flow during early development. Juvenile fish also seem to prefer low water velocities but appear to be more mobile and tolerant of lotic conditions. Adults are found in a variety of stream conditions, especially during migration, but tend to favor pools and deeper water in the fall and winter (Miller et al. 1982).

Outside of the spawning period, adult razorback suckers tend to occupy a variety of shoreline and main-channel habitats, including low runs, shallow to deep pools, backwaters, eddies, and other areas of relatively slow velocity. Occupied areas are often associated with sandy substrates (Tyus 1987; Tyus and Karp 1989). Springtime aggregations have been reported in off-channel impoundments and tributaries. These aggregations are assumed to be associated with spawning (Tyus 1987). Spawning generally occurs from January and February through April, typically over gravel bars, silt, cobbles, and in off-channel ponds. Spawning usually occurs when water temperatures are between 54° and 68°F and at depths that range from 1 to 20 feet (Behnke and Benson 1983).

Factors of Concern: Coal bed methane development has the potential to affect the Colorado pikeminnow and razorback sucker by reducing surface flows and by altering water quality in the San Juan River. Changes in surface flows may occur through two mechanisms. First, the extraction of coal bed methane typically involves the dewatering of subterranean coal seams (groundwater). Over time, the groundwater is replenished by interception and infiltration of surface waters, resulting in a reduction of surface flows. Second, the drilling process requires the use of water for lubrication. Water used for drilling typically originates from surface sources. This use is short term and relatively minor when compared to the groundwater consumption.

Water quality in local streams can also be affected by CBM development. The water "produced" by CBM development is high in total dissolved solids, which could increase the salinity of surface waters in the event of an accidental spill. In addition, the construction of well pads and roads can increase runoff and sediment loads in surface waters. Also, the potential exists for contaminants, such as polycyclic aromatic hydrocarbons (PAHs), to be introduced to surface water sources.

Affected Environment

There are three main tributaries to the San Juan River located within the Project Area, the Piedra River, Los Pinos (Pine) River, and the Animas River. Numerous other tributaries contribute flow to these rivers, the largest of which is the Florida River, tributary to the Animas. Existing coal bed methane development has reduced surface flows in these rivers (Section 3.5, Surface Water Resources, DEIS). It is estimated that existing CBM development depletes 65 acre-feet per year from the Animas and Pine watersheds (Cox et al. 2001).

Several factors have changed water quality within the Project Area and downstream in the San Juan River. Spills of highly saline CBM water have resulted in localized fish kills (Japhet 2002). Methane seep resulting from CBM development is also an issue. Although methane seeps into rivers and streams may have increased as a result of CBM development, they do not appear to have affected water quality (Janowiak 2002; Japhet 2002). One exception occurs on the Animas River, where hydrogen sulphide (H_2S) was detected at relatively high levels. These levels dissipate within several hundred feet of the seep (Janowiak 2002) and tend to preclude the presence of fish in the immediate area (Japhet 2002). However, a healthy trout population occurs downstream of this site.

It is likely that construction of roads, pipelines, and well pads has increased sedimentation in the streams and rivers in the Project Area. Any increases in sediment loads to the Piedra and Pine River systems would not affect the downstream fishes due to the influence of Navajo Reservoir. The Reservoir functions as a sediment trap for these two watersheds. The effects of increased sediment loads from the Animas watershed are unknown.

Activities other than CBM development that have occurred in the Project Area, such as water development, agriculture, residential, and commercial development, and road construction, have likely had substantial effects on the quantity and quality of water that leaves the Project Area. Each of the major drainages in the Project Area has been subject to residential and agricultural development. In addition, completion of the Navajo Dam in 1962 effectively isolated the Pine and Piedra Rivers upstream in the Project Area from the San Juan River. Other diversion structures, including several below the confluence of the San Juan and Animas Rivers, are also potential fish barriers, especially at low flows (FWS 1995a). As of December 31, 2002, FWS had completed consultations on 846,192 acre-feet per year of water depletions in the San Juan River Basin. Of this total, 241,814 acre-feet per year were from Colorado, including the Project Area (SJRB RIP 2003). Collectively, these water development projects have depleted flows, altered flow regimes, changed water temperature and water chemistry, and fragmented habitats within the drainage systems where these species occur.

Water quality has been degraded from historic mining activities, irrigation return flows, sediment input from ground-disturbing activities, and urban runoff in the Project Area. The cumulative effects of decreased surface flow and altered water quality have reduced the quality of habitats and contributed to the decreased population levels for both species.

Competition and other behavioral interactions with introduced non-native fishes is also an issue. The introduction of predatory non-native fish has reduced reproductive success and is the primary reason for failure of recruitment in razorback sucker populations (Tyus 1997).

Effects of the Proposed Action

This section describes the direct, indirect, and cumulative effects of the alternatives on the federally listed fish species potentially affected by the proposed actions. This analysis assumes that produced water will not be discharged into surface drainages. If surface discharge of produced water is considered, additional analysis and consultation will be necessary.

Water Quantity: Coal bed methane development associated with the proposed action will cause additional depletions of groundwater, as described in Section 3.4, Surface Water Resources, DEIS. Surface water depletions will occur as an indirect result of dewatering the Fruitland Formation during CBM production. Over the next 30 to 50 years, a maximum of 200 acre-feet per year of surface water will be intercepted and converted to groundwater as a direct result of CBM development.

In addition, water used during the drilling process will require 156 acre-feet of water over the life of the project. Well construction is estimated to occur over a ten-year period. This assessment assumes an equal distribution of water use over that time, with approximately 16 acre-feet being used for well drilling annually.

Water Quality: Several activities associated with the proposed action may affect surface water quality within and downstream of the Project Area. Increased runoff from access roads, pipelines, and well pads will increase stream sedimentation that may, in turn, cause channel scouring, bank erosion, and alteration of the streambed. The effects to water quality include increases in suspended sediment loads, dissolved solids, and turbidity, and a decrease in concentrations of dissolved oxygen. The degree of soil loss and corresponding increased sediment input to streams is difficult to quantify. Implementation of BMPs and other mitigation measures discussed in Section 3.1.4 (Mitigation and Monitoring), Section 3.4 (Surface Water Resources), and Section 3.5 (Soils) in the DEIS should reduce sediment input to surface waters, as would revegetation of disturbed soils over time. While watershed Best Management Practices (BMP) are intended to minimize these types of impacts, the magnitude and duration of impact will depend on the implementation and maintenance of BMP sediment controls.

Excessive sediment deposition can compromise spawning gravels, impair food sources, fill in rearing pools, and reduce habitat complexity in stream channels. Large quantities of suspended sediment can also alter the fishes feeding efficiency and can cause direct physical harm to fish, such as gill and slime coat damage.

Spills: Accidental spills of fuel, lubricants, drilling fluids, and produced saline water may affect the quality of surface water within and downstream of the Project Area. The potential for such spills will be reduced by implementation of the Spill Prevention Control and Countermeasures (SPCC). Mitigation measures designed to prevent spills and leaks from affecting surface waters are outlined in Section 3.4 (Surface Water Resources) in the DEIS.

Coal bed methane produced water will be disposed of through pipelines to seven subterranean disposal wells. These disposal wells inject the produced water into aquifers located below the CBM producing aquifers. Each well site will include several tanks for temporary storage of produced water in the event that pipelines must be shut down. These tanks will be emptied by truck, and the water will be disposed of at disposal wells.

The likelihood of PAH and produced water spills is low, but possible.

Cumulative Effects

The analysis area for cumulative effects to the Colorado pikeminnow and razorback sucker includes the Project Area and the San Juan River watershed downstream of the Project Area to Lake Powell. Approximately 846,000 acre-feet of water per year are being depleted by a wide variety of current uses. Included in this total is 66 acre-feet per year that will be depleted by new CBM development in the SUIT EIS study area immediately south of the Northern Basin Project Area (BLM et al. 2002).

Although the projected 216 acre-feet per year of depletions associated with this proposed action are small relative to total depletions within the basin, they will contribute to the overall cumulative effect of water depletions on both the Colorado pikeminnow and the razorback sucker.

Impacts to water quality caused by increased sediment loads, and the possibility of spills of fuels, lubricants, drilling fluids, or produced water, are not likely to have measurable effects on habitats of the endangered fishes. Given the distance between the Project Area and the occupied habitats, it would not be possible to distinguish the effects of CBM development from the many other factors contributing to compromised water quality. Although it is reasonable to assume the CBM impacts would be very minor, how these impacts might function in combination with the other cumulative effects to water quality, and how they might eventually influence habitats used by the pikeminnow and sucker, is uncertain.

Determinations

Reduced surface flows and altered water quality can degrade the quantity and quality of aquatic habitat both within and downstream of the Project Area. It has been determined that the amount and quality of water delivered to the lower San Juan River determines habitat suitability for the two endangered fishes (U.S. Fish and Wildlife Service 1995a, SJRB RIP 2003). As a result, it has been the position of the FWS that any depletion of water from the San Juan Basin, regardless of magnitude, timing, duration, or source, contributes to the overall cumulative effect of water depletions on the endangered fishes and has the potential to jeopardize the viability of the population. In keeping with previous findings for like actions, we conclude that the proposed action **may affect, and is likely to adversely affect, the Colorado pikeminnow and razorback sucker.**

Knowlton's Cactus

Status: The Knowlton's cactus was listed as endangered by the FWS in 1979. No officially designated critical habitat has been identified for Knowlton's cactus.

Distribution: This species occurs in a narrow geographic range in La Plata County, Colorado and in San Juan County, New Mexico. It is one of the rarest plants in the United States. The known occurrence in Colorado is located near the Pine River, 5 miles south of the Project Area. There are no known occurrences of this species in the Project Area, although suitable habitats exist for this species in the Project Area. Pre-construction field surveys conducted for 24 APDs submitted to date, documented no occurrences of Knowlton's cactus with this Project Area.

Life History: The Knowlton's cactus is small (3 centimeters in height and usually less than 2.5 centimeters in width) and inconspicuous except when it is flowering. It occurs at an elevation of approximately 6,400 feet. Typical habitat for the Knowlton's cactus includes gravelly alluvial deposits that form rolling gravelly hills covered with pinyon-juniper and sagebrush (Ladyman 2002; Spackman et al. 1997). Suitable habitat for Knowlton's cactus in this project area includes all lands within the pinyon-juniper and sagebrush vegetation types, and all other lands below 8000 feet in elevation. The cactus flowers from April to early May, and fruits are set from late May to early June.

Factors of Concern: Collecting by hobbyists has been considered one of the contributing factors in the rarity of this species (Ecosphere 1995). Any surface-disturbing activity in occupied habitat could be detrimental to individuals and to the species as a whole because of the extreme rarity of the species.

Affected Environment

No CBM-related impacts to the known occurrence outside of the Project Area have been documented. The potential for undocumented occurrences to have been affected by existing CBM development is low because of the extreme rarity of this species. However, no specific data exists to indicate whether undocumented occurrences have been affected.

This species was heavily collected after it was initially discovered and is still popular in the cactus trade. It occurs in an area of intensive oil and gas development, but its distribution is so restricted that adverse impacts have been avoided. The known occurrence is healthy and reproducing and is on privately owned land that is managed as a Nature Conservancy preserve. Efforts are under way to establish two introduced populations, but success is uncertain because of the slow growth of the plants (NMRPTC 1999).

Effects of the Proposed Action

The proposed action is not likely to have any direct, indirect, or cumulative effect on Knowlton's cactus, even though suitable habitat (gravelly alluvial deposits that form rolling gravelly hills covered with pinyon-juniper and sagebrush at elevations of about 6000-7000 feet) for this species exists in the Project Area. As standard protocol, pre-construction surveys will be conducted for all areas of suitable habitat that may be disturbed by activities associated with the proposed action. In the event that any occurrences of Knowlton's cactus are discovered during these surveys, an appropriate buffer will be established around the occurrences of Knowlton's cactus, within which no ground-disturbing activities will occur. Since no ground-disturbing activities will occur within the buffered area surrounding a known population of Knowlton's cactus, it is unlikely that there will be adverse effects to that population.

Cumulative Effects

The cumulative effects analysis area for Knowlton's cactus, 546,648 acres, is defined as the Project Area and that portion of the Southern Ute Indian Reservation within the study area for the oil and gas development on the SUIT EIS. Within this area 5,217 acres of suitable habitat for Knowlton's cactus have been disturbed by CBM development, and an additional 3,655 acres of suitable habitat for Knowlton's cactus will be disturbed under the selected alternative for the SUIT EIS and the proposed action (BLM et al. 2002). Since there are no known prior adverse effects to Knowlton's cactus within the cumulative effects analysis area resulting from past activities, and since there will be no adverse effects to Knowlton's cactus within the cumulative effects analysis area resulting from the proposed action of this project, there will be no adverse cumulative effects to Knowlton's cactus. Mitigation measures and pre-construction surveys designed to avoid effects to Knowlton's cactus from all project activities have been

and will continue to be implemented and will minimize the potential for any adverse effects or cumulative adverse effects to this species.

Determination

Implementation of the proposed action, as described above **may affect, but is not likely to adversely affect Knowlton's cactus** based on discountable effects. This determination is based on the fact that there are no known occurrences of this species in the Project Area, because surveys done in the Project Area have not found it, and the fact that if the species is found in the Project Area through pre-construction surveys, no ground-disturbing activities will occur within the buffered area surrounding that population of Knowlton's cactus.

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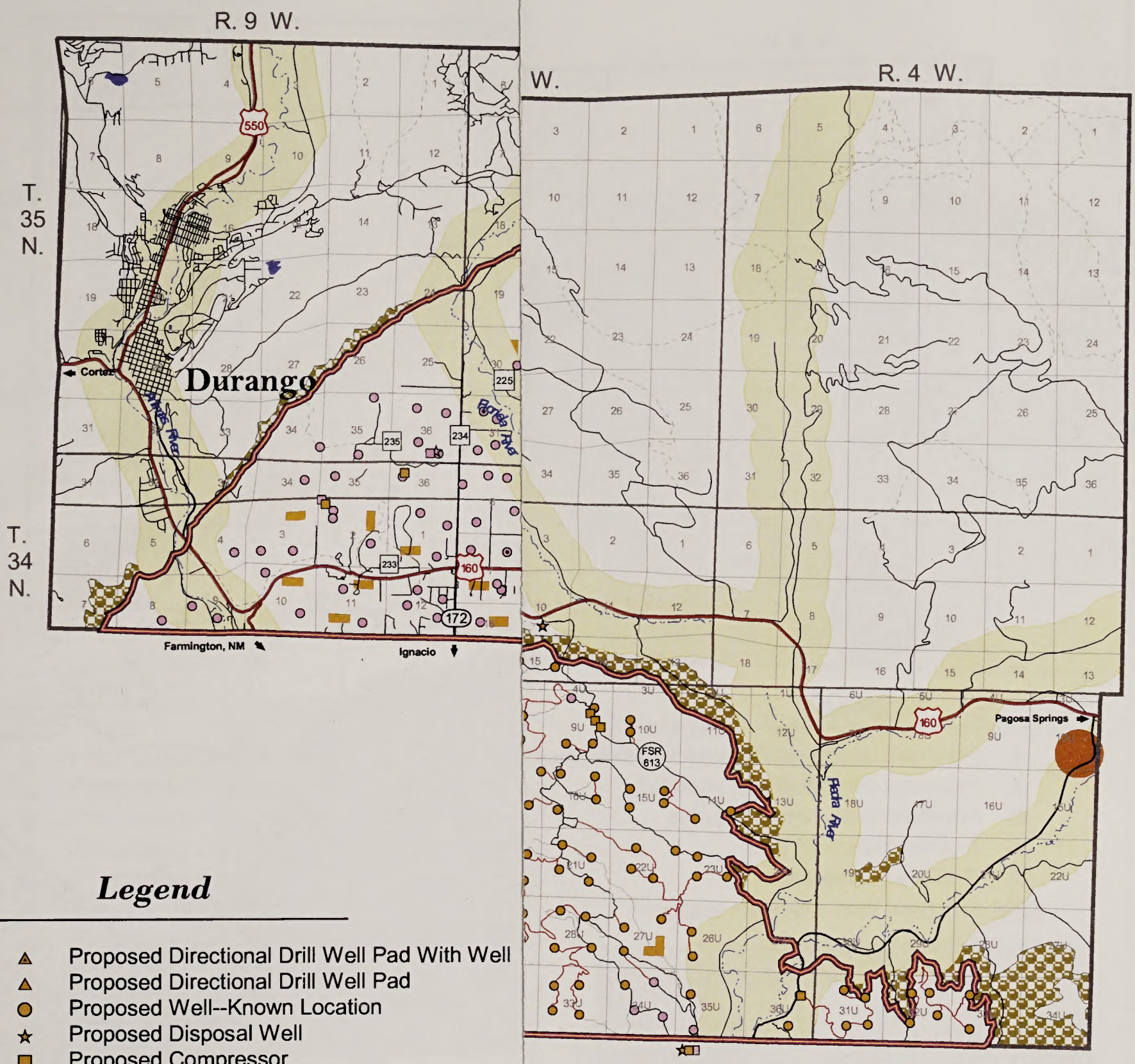
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Legend

- Proposed Directional Drill Well Pad With Well
- Proposed Directional Drill Well Pad
- Proposed Well--Known Location
- Proposed Disposal Well
- Proposed Compressor
- Existing Compressor
- Existing Non-Fruitland Well
- Existing Fruitland Well
- Existing Disposal Well
- Project Area Boundary
- Proposed Access Road/Flowline
- U.S. Highway
- Primary Road
- Secondary Road
- Closed USFS Road
- Trail
- Stream/River
- Lake/Reservoir
- Bald Eagle Roost Area 243 Acres
- Bald Eagle Winter Concentration Area 11,554
- Fruitland Formation Outcrop

**There are no Bald Eagle nests within the project area.*

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ANALYSIS AREA: LA PLATA & ARCHULETA COUNTIES, COLORADO	
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R. 9 W. R. 8 W. R. 7 W. R. 6 W. R. 5 W. R. 4 W.

T. 35 N.

T. 34 N.

Durango

Bayfield

Gem Village

Farmington, NM

Ignacio

Cortez

Pagosa Springs

Los Pinos River

Florida River

Lake Creek

Spring Creek

Hesse Creek

Basin Creek

Bauer Creek

LA PLATA COUNTY
ARCHULETA COUNTY

Southern Ute Indian Reservation

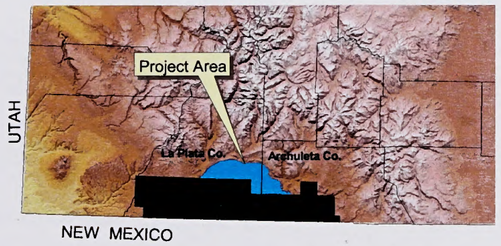
T. 34 N. U.

Southern Ute Indian Reservation

Legend

- Proposed Directional Drill Well Pad With Well
- Proposed Directional Drill Well Pad
- Proposed Well--Known Location
- Proposed Disposal Well
- Proposed Compressor
- Existing Compressor
- Existing Non-Fruitland Well
- Existing Fruitland Well
- Existing Disposal Well
- Project Area Boundary
- Proposed Access Road/Flowline
- U.S. Highway
- Primary Road
- Secondary Road
- Closed USFS Road
- Trail
- Stream/River
- Lake/Reservoir
- Bald Eagle Roost Area 243 Acres
- Bald Eagle Winter Concentration Area 11,554 Acres
- Fruitland Formation Outcrop

**There are no Bald Eagle nests within the project area.*



N W E S

2 0 2 4 6 8 *Kilometers*

2 0 2 4 6 8 *Miles*

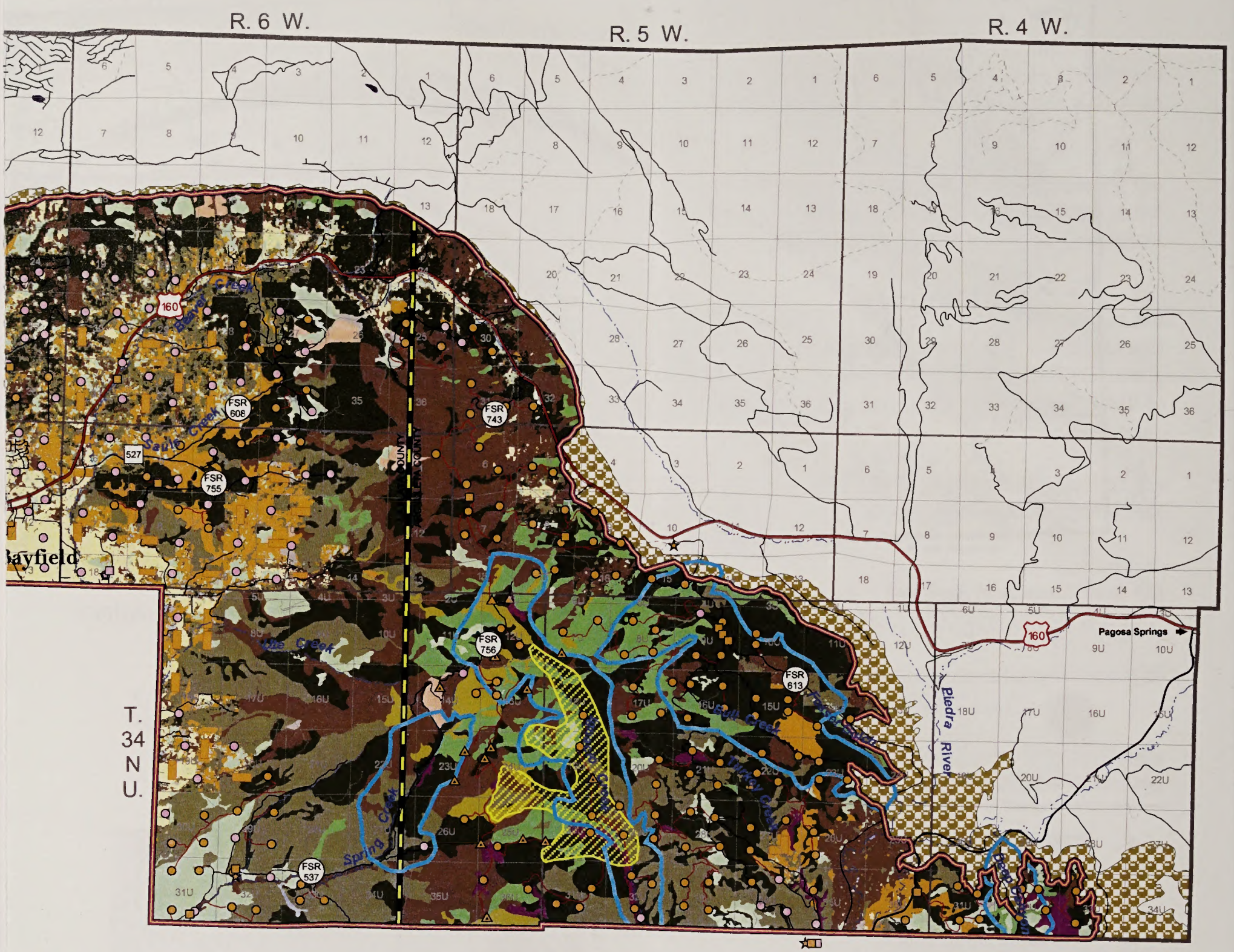
La Plata County transportation data provided by the La Plata County Transportation Study, 1998. Hydrologic and Archuleta County transportation features extracted from 1:100,000 USGS SDTS data.
Existing wells extracted from COGCC well database and edited by the BLM & USFS.
Bald Eagle habitat extracted from CDOW data.

Transverse Mercator Projection
1927 North American Datum
Zone 13

NORTHERN SAN JUAN BASIN CBM EIS

BALD EAGLE WINTER CONCENTRATION AREA & INDUSTRY'S PROPOSED ACTION

ANALYSIS AREA: LA PLATA & ARCHULETA COUNTIES, COLORADO	
Date: 10/21/03	ArcView File: C:\994-sanjuan\wildlife.apr
	Prepared By: JG



Southern Ute Indian Reservation

La Plata County transportation data provided by the La Plata County Transportation Study, 1998. Hydrologic and Archuleta County transportation features extracted from 1:100,000 USGS SDTS data. Existing wells extracted from COGCC well database and edited by the BLM & USFS. Potential habitat areas surveyed by the U.S. Forest Service and certified Mexican Spotted Owl Contractors.

8 Kilometers

6 8 Miles

Transverse Mercator Projection
1927 North American Datum
Zone 13

NORTHERN SAN JUAN BASIN CBM EIS

MEXICAN SPOTTED OWL SURVEY AREAS (2002-2003), SUITABLE HABITAT, & INDUSTRY'S PROPOSED ACTION

ANALYSIS AREA: LA PLATA & ARCHULETA COUNTIES, COLORADO

Date: 10/21/03	ArcView File: C:\994-sanjuan\wildlife.apr
	Prepared By: JG

R. 9 W.

R. 4 W.

T. 35 N.

T. 34 N.

Durango

Cortez

Farmington, NM

Ignacio

Pagosa Springs

Animas River

Florida River

Piedra River

550 225 235 234 233 160 172 FSR 613

Legend

- Proposed Directional Drill Well Pad W
- Proposed Directional Drill Well Pad
- Proposed Well--Known Location
- Proposed Disposal Well
- Proposed Compressor
- Existing Compressor
- Existing Non-Fruitland Well
- Existing Fruitland Well
- Existing Disposal Well
- Project Area Boundary
- Proposed Access Road/Flowline
- U.S. Highway
- Primary Road
- Secondary Road
- Closed USFS Road
- Trail
- Stream/River
- Lake/Reservoir
- Proposed Well--General Location
- Southwestern Willow Flycatcher Suitab
- Southwestern Willow Flycatcher Poten
- Fruitland Formation Outcrop

ian Reservation

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rtation

latabase

eystone.

NORTHERN SAN JUAN BASIN CBM EIS

SOUTHWESTERN WILLOW FLYCATCHER SUITABLE HABITAT & INDUSTRY'S PROPOSED ACTION

ANALYSIS AREA: LA PLATA & ARCHULETA COUNTIES, COLORADO

Date: 10/21/03	ArcView File: C:\994-sanjuan\wildlife.apr
	Prepared By: JG

R. 9 W. R. 8 W. R. 7 W. R. 6 W. R. 5 W. R. 4 W.

T. 35 N.

T. 34 N.

Durango

Bayfield

Southern Ute Indian Reservation

T. 34 N. U.

Pagosa Springs

Southern Ute Indian Reservation

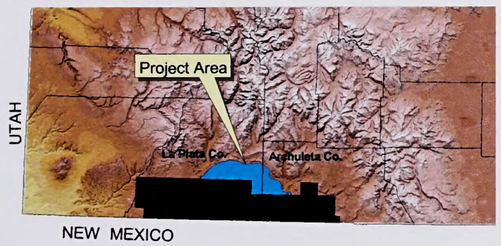
Legend

- Proposed Directional Drill Well Pad With Well
- Proposed Directional Drill Well Pad
- Proposed Well--Known Location
- Proposed Disposal Well
- Proposed Compressor
- Proposed Well--General Location
- Existing Compressor
- Existing Non-Fruitland Well
- Existing Fruitland Well
- Existing Disposal Well
- Project Area Boundary
- Stream/River
- Lake/Reservoir

Vegetation Types

- Agriculture
- Aspen
- Barren
- Gambel Oak
- Grasslands
- Mixed Conifer
- Mountain Shrub
- Pinyon-Juniper
- Ponderosa Pine
- Riparian
- Sagebrush
- Old Growth

- Mexican Spotted Owl Survey Areas 2002-2003 10,535 Acres
- Mexican Spotted Owl Suitable Habitat Area 1,980 Acres
- Fruitland Formation Outcrop



2 0 2 4 6 8 *Kilometers*

2 0 2 4 6 8 *Miles*

Transverse Mercator Projection
1927 North American Datum
Zone 13

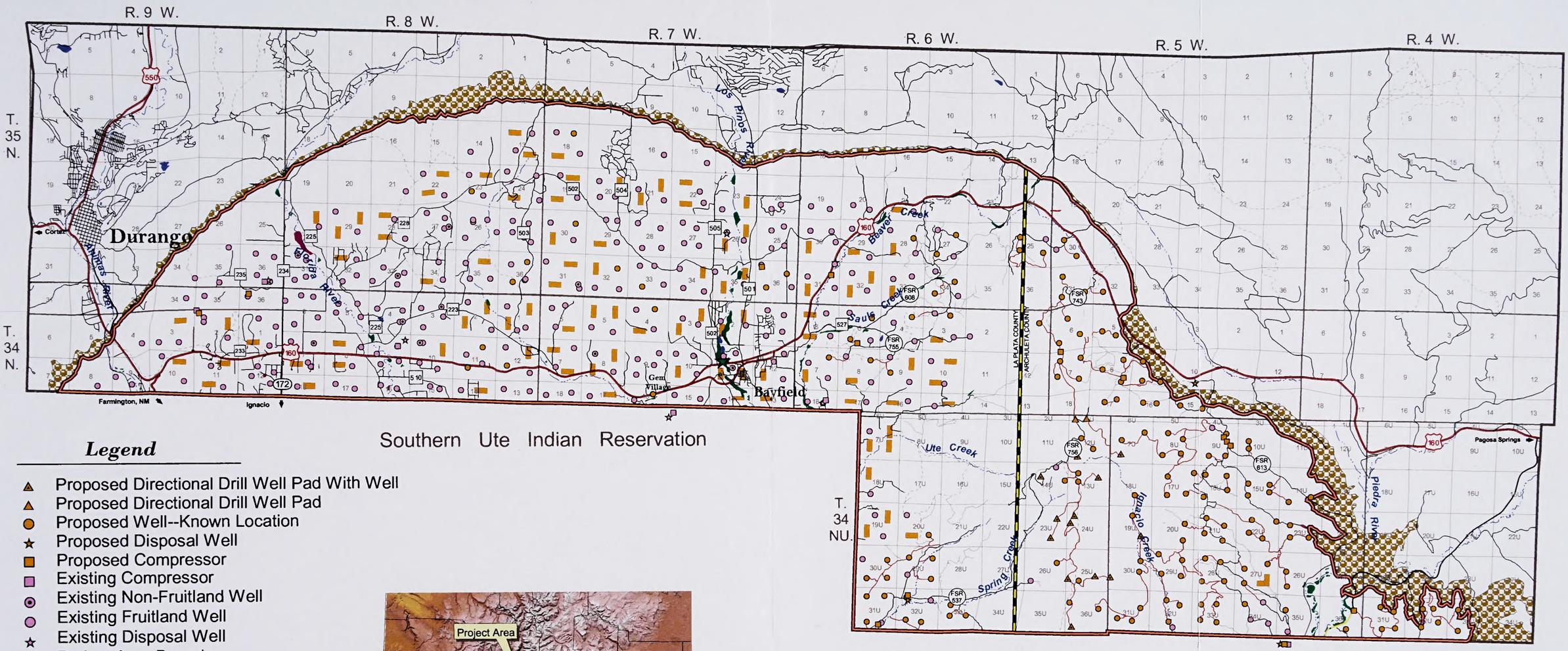
La Plata County transportation data provided by the La Plata County Transportation Study, 1998. Hydrologic and Archuleta County transportation features extracted from 1:100,000 USGS SDTS data.
Existing wells extracted from COGCC well database and edited by the BLM & USFS.
Potential habitat areas surveyed by the U.S. Forest Service and certified Mexican Spotted Owl Contractors.

NORTHERN SAN JUAN BASIN CBM EIS

MEXICAN SPOTTED OWL SURVEY AREAS (2002-2003), SUITABLE HABITAT, & INDUSTRY'S PROPOSED ACTION

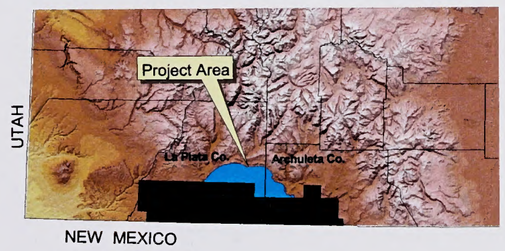
ANALYSIS AREA: LA PLATA & ARCHULETA COUNTIES, COLORADO

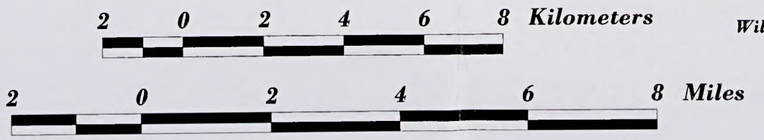
Date: 10/21/03	ArcView File: C:\994-sanjuan\wildlife.apr
	Prepared By: JG



Legend

- Proposed Directional Drill Well Pad With Well
- Proposed Directional Drill Well Pad
- Proposed Well--Known Location
- Proposed Disposal Well
- Proposed Compressor
- Existing Compressor
- Existing Non-Fruitland Well
- Existing Fruitland Well
- Existing Disposal Well
- Project Area Boundary
- Proposed Access Road/Flowline
- U.S. Highway
- Primary Road
- Secondary Road
- Closed USFS Road
- Trail
- Stream/River
- Lake/Reservoir
- Proposed Well--General Location
- Southwestern Willow Flycatcher Suitable Habitat 457 Acres
- Southwestern Willow Flycatcher Potential Habitat 67 Acres
- Fruitland Formation Outcrop





La Plata County transportation data provided by the La Plata County Transportation Study, 1998. Hydrologic and Archuleta County transportation features extracted from 1:100,000 USGS SDTS data. Existing wells extracted from COGCC well database and edited by the BLM & USFS. Willow Flycatcher habitat delineated by Greystone.

Transverse Mercator Projection
1927 North American Datum
Zone 13

NORTHERN SAN JUAN BASIN CBM EIS

SOUTHWESTERN WILLOW FLYCATCHER SUITABLE HABITAT & INDUSTRY'S PROPOSED ACTION

ANALYSIS AREA: LA PLATA & ARCHULETA COUNTIES, COLORADO

Date: 10/21/03	ArcView File: C:\994-sanjuan\wildlife.apr
	Prepared By: JG

Appendix I
Biological Evaluation

BIOLOGICAL EVALUATION

NORTHERN SAN JUAN BASIN COAL BED METHANE DEVELOPMENT ENVIRONMENTAL IMPACT STATEMENT

February 04, 2004

United States Department of Agriculture
Forest Service

San Juan Public Lands
Archuleta and La Plata Counties

Prepared by:

Anthony Garcia, District/Field Office Wildlife Biologist
Columbine Ranger District/Field Office

Matt Schweich, Senior Ecologist
Greystone Environmental Consultants, Inc.

Jeff Redders, Forest Ecologist
San Juan Public Lands Center

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1.0 INTRODUCTION

Forest Service Manual (FSM) 2672.4 states: "As part of the National Environmental Policy Act (NEPA) decision making process, review proposed U.S. Department of Agriculture, Forest Service (FS) programs or activities in sufficient detail to determine how an action or proposed action will affect any species which is listed under the Endangered Species Act, proposed for such federal listing, or designated in Region 2 as sensitive."

This Biological Evaluation (BE) is intended to provide sufficient information to determine if the Proposed Action or alternatives would affect species designated as sensitive by the Regional Forester in Region 2 (as of March 21, 1994), listed as sensitive by the Director of BLM in Colorado (as of March 17, 2000), and Federal Candidates for listing by the U.S. Fish in Wildlife Service (as of March 3, 2003). This BE was prepared in accordance with the FS Region 2 directives set forth in FSM 2672.4, Supplement R2-2600-94-2.

A separate Biological Assessment (BA), as required by section 7 of the Endangered Species Act, has been prepared to address species that are federally listed or are proposed for federal listing.

1.1 PURPOSE

The objectives of this BE, as set forth in FSM 2672.41, are:

- To ensure that FS actions do not contribute to loss of viability of any native or desired non-native plant or animal species;
- To ensure that activities do not cause the status of any species to move toward federal listing; and
- To incorporate concerns for sensitive species throughout the planning process, reducing negative impacts to species and enhancing opportunities for mitigation.

To accomplish these objectives, this BE reviews the proposed action (Northern San Juan Basin Coal Bed Methane Project) and alternatives in sufficient detail to determine the level of impact that would occur to each sensitive species evaluated. One of four possible determinations will be chosen based on the best available scientific literature, a thorough analysis of the potential effects of the project, and the professional judgment of the biologists who completed the evaluation. The four possible determinations (from FSM 2672.42) are as follows:

- "No impact" – where no effect is expected;
- "Beneficial impact" – where effects are expected to be beneficial;
- "May adversely impact individuals, but not likely to result in a loss of viability on the planning area, nor cause a trend to federal listing or a loss of species viability range wide" – where effects are expected to be insignificant (immeasurable), or discountable (extremely unlikely); and
- "Likely to result in a loss of viability on the planning area, in a trend to federal listing, or in a loss of species viability range wide" – where effects are expected to be detrimental and substantial.

1.2 SUMMARY OF EVALUATION

A list of 41 FS sensitive species was initially considered in this evaluation. After information had been examined on occurrence and the availability of suitable habitats, 18 of these species were not expected to occur in the Project Area and were therefore removed from further consideration. A complete evaluation

was presented for each of the remaining 23 species, including a discussion of protective status, distribution, life history, factors of concern, environmental baseline, effects, determination, and recommendations for mitigation measures, when appropriate. Of the 23 species that were evaluated, a determination of "no impact" was provided for three species: Pagosa skyrocket, Pagosa Springs bladderpod, and western burrowing owl. A determination of "may adversely impact individuals, but not likely to result in a loss of viability on the planning area, nor cause a trend toward federal listing or a loss of species viability range wide" was assigned to the 20 remaining sensitive species. Table 1 presents the list of sensitive species considered and a summary of the determinations for each alternative.

Table 1 Summary Of Effect Determinations

Species	Evaluated in Detail?	Determinations*						
		Alt. 1	Alt 1A	Alt 1B	Alt. 2	Alt. 3	Alt. 4	Alt. 5
Southern maidenhair fern	No	NI	NI	NI	NI	NI	NI	NI
Reflected moonwort	No	NI	NI	NI	NI	NI	NI	NI
Pale moonwort	No	NI	NI	NI	NI	NI	NI	NI
Altai cotton-grass	No	NI	NI	NI	NI	NI	NI	NI
Colorado tansy-aster	No	NI	NI	NI	NI	NI	NI	NI
American marten	No	NI	NI	NI	NI	NI	NI	NI
Wolverine	No	NI	NI	NI	NI	NI	NI	NI
Common loon	No	NI	NI	NI	NI	NI	NI	NI
Ferruginous hawk	No	NI	NI	NI	NI	NI	NI	NI
Osprey	No	NI	NI	NI	NI	NI	NI	NI
Columbian sharp-tailed grouse	No	NI	NI	NI	NI	NI	NI	NI
American bittern	No	NI	NI	NI	NI	NI	NI	NI
White-faced ibis	No	NI	NI	NI	NI	NI	NI	NI
Greater sandhill crane	No	NI	NI	NI	NI	NI	NI	NI
Western yellow-billed cuckoo	No	NI	NI	NI	NI	NI	NI	NI
Boreal owl	No	NI	NI	NI	NI	NI	NI	NI
Boreal toad	No	NI	NI	NI	NI	NI	NI	NI
Colorado River cutthroat trout	No	NI	NI	NI	NI	NI	NI	NI
Aztec milkvetch	Yes	MAII	MAII	MAII	MAII	MAII	MAII	MAII
Giant helleborine	Yes	MAII	MAII	MAII	MAII	MAII	MAII	MAII
Pagosa skyrocket	Yes	NI	NI	NI	NI	NI	NI	NI
Pagosa springs bladderpod	Yes	NI	NI	NI	NI	NI	NI	NI
Dwarf shrew	Yes	MAII	MAII	MAII	MAII	MAII	MAII	MAII
Spotted bat	Yes	MAII	MAII	MAII	MAII	MAII	MAII	MAII
Townsend's big-eared bat	Yes	MAII	MAII	MAII	MAII	MAII	MAII	MAII
Ringtail	Yes	MAII	MAII	MAII	MAII	MAII	MAII	MAII
Northern goshawk	Yes	MAII	MAII	MAII	MAII	MAII	MAII	MAII
Merlin	Yes	MAII	MAII	MAII	MAII	MAII	MAII	MAII
Western burrowing owl	Yes	NI	NI	NI	NI	NI	NI	NI
Flammulated owl	Yes	MAII	MAII	MAII	MAII	MAII	MAII	MAII
Lewis' woodpecker	Yes	MAII	MAII	MAII	MAII	MAII	MAII	MAII
Three-toed woodpecker	Yes	MAII	MAII	MAII	MAII	MAII	MAII	MAII
Olive-sided flycatcher	Yes	MAII	MAII	MAII	MAII	MAII	MAII	MAII
Purple martin	Yes	MAII	MAII	MAII	MAII	MAII	MAII	MAII

Table 1 Summary Of Effect Determinations								
		Determinations*						
Species	Evaluated in Detail?	Alt. 1	Alt 1A	Alt 1B	Alt. 2	Alt. 3	Alt. 4	Alt. 5
Pygmy nuthatch	Yes	MAII	MAII	MAII	MAII	MAII	MAII	MAII
Golden-crowned kinglet	Yes	MAII	MAII	MAII	MAII	MAII	MAII	MAII
Loggerhead shrike	Yes	MAII	MAII	MAII	MAII	MAII	MAII	MAII
Fox sparrow	Yes	MAII	MAII	MAII	MAII	MAII	MAII	MAII
Tiger salamander	Yes	MAII	MAII	MAII	MAII	MAII	MAII	MAII
Northern leopard frog	Yes	MAII	MAII	MAII	MAII	MAII	MAII	MAII
Milk snake	Yes	MAII	MAII	MAII	MAII	MAII	MAII	MAII

* NI – "No Impact"; MAII – "May adversely impact individuals, but not likely to result in a loss of viability on the planning area, nor cause a trend to federal listing or a loss of species viability range wide."

2.0 DESCRIPTION OF THE PROPOSED ACTION

This section describes the Project Area, the types of activities that will take place under each alternative, and the committed conservation measures, and summarizes the specific details of each alternative.

2.1 INTRODUCTION

Eight companies (the Companies) propose further development of coal bed methane (CBM) in La Plata and Archuleta Counties in southwestern Colorado. Under this proposal, the Companies would drill and operate additional CBM wells and would construct the necessary ancillary facilities, such as roads, pipelines, and compressor stations.

The Companies hold valid federal, state, and private leases for oil and natural gas in the Project Area. The purpose of the Companies' proposal is to expand drilling and production of CBM to additional locations on approved leases in response to the changes in well spacing rules enacted in May 2000 by the U.S. Bureau of Land Management (BLM) and in July 2000 by the Colorado Oil and Gas Conservation Commission (COGCC), and in response to the desire to expand CBM production in the Project Area.

2.2 PROJECT AREA

The Project Area consists of the approximately 125,000-acre portion of the San Juan Basin north of the Southern Ute Indian Reservation (Figure 1). Land ownership within the Project Area includes approximately 7,000 acres of federal lands administered by the BLM, 50,000 acres of federal lands administered by the FS, 13,000 acres of private (fee) lands with federal minerals, and 55,000 acres of private and state lands with non-federal minerals.

The San Juan National Forest (SJNF) administers more than 49,000 acres of land within the Project Area. More than 19,000 acres of ponderosa pine occur on National Forest System (NFS) lands within the Project Area, the most of any single vegetation type. Pinyon-juniper and Gambel oak each account for more than 9,000 acres, and mixed conifer accounts for more than 4,000 acres. Other vegetation types on NFS lands in the Project Area include grassland, sagebrush, mountain shrub, aspen, riparian, barren, and water. Table 2 presents the existing acreage within each habitat structural stage for each vegetation type on NFS lands in the Project Area.

2.3 ACTIVITIES COMMON TO ALL ALTERNATIVES

The overall life of the proposed project would be 30 years. Well construction would begin during 2004, and drilling would continue for 5 years. The productive life of each well is expected to be 25 to 30 years. Production from the wells drilled at the end of the 5-year drilling period is expected to conclude by 2038. Final reclamation of each well would occur during the 2 to 3 years immediately after the end of its productive life. Thus, the Proposed Action would be completed by 2040.

Each alternative contains drilling windows. These windows are areas of 22 acres where the exact well location is not yet known, but where the general area has been determined. Assumptions were made on the locations of on well pads, roads, and pipelines for these windows. In several cases, drilling windows contain more than one surface or mineral ownership, as well as different surface resources (for example, vegetation types and wildlife habitats). The amount of wells, roads, and other facilities that would be located on a particular surface or mineral ownership or affect a certain resource was assumed to be in proportion to the presence of the ownership or resource in all drilling windows in the Project Area.

TABLE 2 HABITAT STRUCTURAL STAGES ON NFS LANDS IN THE PROJECT AREA

Vegetation Type	Structural Habitat Stage												
	n/a	1M	1T	2S	2T	3A	3B	3C	4A	4B	4C	5X	Total
Grasslands	0	2,285	903	0	0	0	0	0	0	0	0	0	3,188
Sagebrush	0	0	0	1,353	0	0	0	0	0	0	0	0	1,353
Pinyon-Juniper	0	0	0	0	0	2,161	4,485	0	1,741	1,249	0	0	9,637
Mountain Shrub	0	0	0	437	0	0	0	0	0	0	0	0	437
Gambel Oak	0	0	0	9,444	254	0	0	0	0	0	0	0	9,698
Ponderosa Pine	0	0	0	0	0	255	538	31	9,431	8,331	55	746	19,388
Mixed Conifer	0	0	0	0	0	18	857	108	364	2,539	463	0	4,348
Aspen	0	0	0	0	0	276	405	19	102	426	21	0	1,249
Riparian	0	0	0	3	0	0	0	0	23	0	0	0	26
Agriculture	0	0	0	0	0	0	0	0	0	0	0	0	0
Barren	78	0	0	0	0	0	0	0	0	0	0	0	78
Water	2	0	0	0	0	0	0	0	0	0	0	0	2
Total	80	2,285	903	11,237	254	2,711	6,285	158	11,661	12,545	540	746	49,404

2.3.1 Well Development

Well development consists of a number of sequential phases, as described below. Each of these phases is described in detail in Chapter 2 of the Environmental Impact Statement (EIS) for this project.

Pre-construction Phase

During the pre-construction phase, the well location is identified and an on-site inspection is conducted. An Application for Permit to Drill (APD) is submitted and, when the required environmental analysis is complete, it is generally approved with conditions attached. During this phase, the need for biological surveys is assessed, surveys are conducted if necessary, survey results are reviewed, and any additional mitigation measures are developed and incorporated as conditions of approval for the APD. This process is discussed in more detail in Section 2.3.2.

Construction Phase

During the construction phase, access roads, well pads, and ancillary production facilities such as pipelines for gas and produced water, electrical facilities, disposal sites, and compressor stations would be constructed. The lengths of the access roads would average ¼ mile for private and state lands, ⅓ mile for BLM lands, and ½ mile for NFS lands. The average width of a road accessing a well pad would be 25 feet. Access roads would disturb 0.8 acres per well on private or state surface, 1 acre per well on BLM lands, or 1.5 acres per well on NFS lands. Water would be used to abate dust and for other construction practices. Approximately 60 acre-feet of water overall would be used during construction of roads, pipelines, well pads, and compressor facilities. Water would come from existing local sources; no new withdrawals of groundwater or surface water are planned.

The disturbance associated with each well pad would vary with the number of wells drilled. Pads with a single well would cause 1.4 acres of disturbance. The disturbance would increase by about 25 percent

with each additional well on a pad. Pads with two wells would disturb 1.75 acres, and pads with three wells would disturb 2.1 acres.

Gathering pipelines would parallel existing or proposed roads where possible. The right-of-way (ROW) would be reclaimed after the pipelines are installed and tested, as soon as weather and growing conditions are favorable. Gas and produced water gathering pipelines would require a 40-foot ROW, all of which would be reclaimed. Construction would disturb 4.85 acres per mile of pipeline.

Electricity may be used during the development and production phases. Generators would be used where electricity is not available. In other cases, distribution lines would connect wells and compressor facilities with the existing transmission and distribution system. Installation would occur within a 20-foot wide ROW, of which 5 feet would overlap with the adjacent access road. The remaining 15 feet would be new disturbance that would be reclaimed after construction. Construction would disturb 1.82 acres per mile of distribution line.

The pads for some disposal wells may be collocated with compressor units on a compressor station, so that no additional disturbance would be involved. An access road, produced water pipeline and, possibly, an electrical distribution line would be constructed to each disposal well. Where disposal wells are not collocated with compressors, an area of 3 acres would be disturbed over the life of the project.

Each compressor station would cause 6 acres of long-term disturbance over the life of the project. Two stations would require construction of pipelines to connect the stations to existing pipelines. Although the specific routes have not been identified, it has been estimated that 17 miles of new pipeline would be required. These pipelines would disturb 82 acres of surface area. No long-term disturbance is anticipated because all components of the pipelines would be buried and the surface would be revegetated.

Drilling and Completion Phase

As part of the drilling and completion phase, the access road and well pad would be reclaimed if the well is not successfully completed. If the well is completed successfully, however, gravel would be used to surface all newly constructed roads to ensure a surface adequate for year-round travel.

The drill rig, other equipment, and supplies would be trucked to the well pad. The Companies propose to use three to four drilling rigs continuously during the year in the western portion of the Project Area. The Companies would use four rigs, limited to seasonal restrictions, on the eastern portion. Drilling each well would likely involve about 6 to 12 days and an estimated 6 to 19 workers.

After each well is drilled and completed, the Companies would reclaim the parts of the pad and reserve pit that are not needed for production. Based on information for CBM wells completed to date, about 0.4 acre of each pad would be reclaimed. The rest of the pad (1 acre) would comprise long-term disturbance for the life of the project.

After a well is drilled, the Companies would initiate a completion and testing program. A completion rig would be used. The program, which would last 7 to 14 days, would include perforating the well's steel casing, hydraulically fracturing the producing formation, and installing production pipe connected to a series of valves and fittings on the well head.

Production and Maintenance Phase

Routine maintenance of access roads would occur year-round or as site conditions permit during the production and maintenance phase. Dust abatement procedures would not be routinely employed on the

roads during production and maintenance. The counties would continue to maintain existing county roads, and the Companies would maintain all other project-related roads.

Surface production facilities installed at the well site would include the well head, a pump, separators and dehydrators, gas metering facilities, tanks for produced water, and a connection to the gas- and produced water-gathering systems. The total area that would be used for long-term production operations at a single well pad would occupy 1 acre or less. All areas that are not needed for production facilities would be covered with the topsoil that was stored during construction for previous phases. Interim reclamation of these areas would take place as soon as weather and growing conditions are favorable. Company personnel or contractors would visit each producing well daily to ensure that the equipment is functioning properly. Some companies may supplement these efforts with remote monitoring.

Periodically, a well may require a workover. These repairs would occur during daylight only and usually would be completed in several days. Some limited situations may require several weeks to finish a workover, however. The frequency for this type of work cannot be accurately projected because workovers vary between wells, depending on the circumstances. Therefore, one 14-day workover per year per well is assumed.

The total water production for the proposed wells located in the eastern portion of the Project Area would average about 75 barrels per day per well. In the western portion of the Project Area, rates of production would vary from 100 to 200 barrels of water per day per well. The Companies would dispose of produced water by transporting it by truck or pipeline to approved disposal wells. Alternatively, some of the water produced by wells on the eastern side of the Project Area may be held in evaporation pits located outside of the Project Area or possibly discharged to surface drainages. However, surface discharge is currently considered speculative because treatment requirements and costs are unknown. As a result, additional analysis and permitting would be required before any surface discharge can occur.

Decommissioning and Reclamation Phase

The alternatives assume each well would produce during its 25- to 30-year economic lifetime. Dry holes would be reclaimed following the procedures described below, with the exception that reclamation would begin as soon as possible after the Companies conclude that the well would not produce economically.

Similar reclamation procedures would be applied in all disturbed areas. Gravel surfaces would be removed. Disturbed areas would be backfilled as needed and graded to desired configuration. Erosion control measures would be installed, if necessary. All road disturbances would be revegetated with a seed mixture approved by the Authorized Officer or landowner. The surface would be tilled and prepared for seeding. All seed would be certified as weed free. Seeding and planting would be repeated until satisfactory revegetation is achieved.

Access roads would be closed unless the landowner or land manager wishes to make use of these roads and accepts responsibility for future maintenance. All aboveground facilities and equipment, including the well equipment, compressors, amine and dehydration units, and buildings, would be disassembled and removed from the site. Pipelines would be cleaned, disconnected, plugged, and then abandoned in place to avoid unnecessary disturbance of the land surface. Underground power lines would be disconnected and abandoned in place to avoid unnecessary surface disturbance. Aboveground facilities related to the underground power lines would be removed, and any disturbance associated with these facilities would be reclaimed. Aboveground electrical power lines would be disconnected, and the power poles and lines would be removed. Disposal wells would be abandoned and reclaimed.

2.3.2 PROJECT DESIGN RECOMMENDATIONS

The EIS specifies two levels of environmental protection measures. The first level includes mitigation measures specified in Chapter 3 of the EIS that apply to project implementation in general. The second level includes mitigation measures that are applied to specific well locations after the Companies have filed APDs and site inspections have been completed. The APDs submitted by a Company must be consistent with the environmental protection measures set forth in the EIS. They would be modified to address specific issues that are identified during on-site inspections of the proposed well site. The following measures that apply to sensitive species have been identified in the EIS:

- Minimize the number and length of new access roads.
- Construct access roads to new wells as spurs from the existing road system rather than as separate primary access roads where possible.
- Prohibit employees and contractors from bringing dogs or carrying firearms on site.
- Conduct periodic employee and contractor wildlife awareness programs covering seasonal wildlife requirements and sensitivities, how disturbances affect wildlife, and ways personnel can reduce disturbances.
- Implement a travel management plan on NFS lands that shifts roads currently designated as open to motorized use to a closed designation to help reduce adverse indirect impacts from disturbance.
- Implement effective road closures (to public, motorized uses) to the extent possible on newly developed road systems.
- Remove all contaminants from project sites to avoid exposure to wildlife.
- Fence or cover emergency pits that are connected to each disposal well to prevent animals from drinking any contaminated water.
- Install mufflers or screens on exhaust systems to the extent possible to avoid wildlife entrapment and mortality.
- Minimize disturbance by clearing and otherwise disturbing only vegetation within the minimum area needed for safe and efficient development, production, and maintenance. Extra efforts should be used to avoid disturbance of stands of old-growth ponderosa pine.
- Protect and retain snags and down-dead logs to the extent possible. All snags and logs may be removed from areas of active construction and ground disturbance. Snags and logs outside of disturbance areas should be removed only when they pose a hazard to human life and property, however.
- Locate well pads, compressors, and other non-linear facilities outside of riparian areas, wetlands, and floodplains to protect the biological and hydrologic features.
- Conduct preconstruction surveys for Aztec milkvetch, giant helleborine, Pagosa skyrocket, and Pagosa Springs bladderpod in all potential areas of disturbance that are identified as suitable habitat during the pre-construction phase of the project.
- Avoid individuals and populations of Aztec milkvetch, giant helleborine, Pagosa skyrocket, or Pagosa Springs bladderpod that may be affected by activities.

2.4 ALTERNATIVES

Seven alternatives were developed to respond to the legal and policy requirements and to the issues identified with Industry's Proposed Action during scoping. The alternatives also cover the range of development possibilities. Each of these alternatives is initially considered practical or feasible from a technical or environmental perspective. The seven alternatives include: the Industry Proposed Action (Alternative 1), Utilization of Short-reach Horizontal Drilling to the Implement Industry Proposed Action (Alternative 1A), Utilization of Long-reach Horizontal Drilling to Implement the Industry Proposed Action (Alternative 1B), Maximum Development (Alternative 2), No New Development in the HD Mountains Inventoried Roadless Area (Alternative 3), Continuation of Current Management Direction (Alternative 4), and No Action (Alternative 5), and are described below. Detailed descriptions of each alternative are included in Chapter 2 of the EIS.

2.4.1 Alternative 1 —Proposed Action

The Proposed Action Alternative is the Companies' CBM development proposal. Under this alternative, the companies, would drill, complete, operate, decommission, and reclaim 296 new CBM wells, which would be drilled from 273 well pads. The CBM gas field would be developed to a density of four wells per section throughout most of the Project Area. The Companies propose limited development in the Spring Creek area of the SJNF. Surface occupancy would be avoided on 25 well windows in the HD Mountains because of steep slopes and inaccessible terrain, but wells would be drilled directionally to those locations. The Companies would construct 115.7 miles of access road and gathering lines, up to seven disposal wells, and 14 compressors. Short-term disturbance would equal 1,114 acres, and long-term disturbance would equal 676 acres.

2.4.2 Alternatives 1A and 1B

Alternative 1A would use short-reach horizontal drilling to drill multiple locations from a single well pad. The assumed horizontal distance from the well pad to the downhole target is limited to 1,800 feet based on the results for recent tests of this drilling method in northern New Mexico. Furthermore, four wells have been drilled using this approach in the San Juan Basin, with mixed results. Production rates, economics, and issues regarding stability of well bores within target formations are being monitored; the drilling method is therefore considered experimental in the San Juan Basin at this time.

Using short-reach horizontal drilling, on average two to three well pads access a total of four target bottom hole locations per section. Horizontal drilling can be applied to limit surface impacts, but is limited in its application by the need to extend the access road system to almost all square-mile sections throughout the Project Area. In addition, horizontal drilling does not lend itself to all drilling applications. Alternative 1A also uses directional drilling where the depth to the coals is sufficient to achieve the target horizontal offset required to reach from a well pad to the adjacent well window.

Alternative 1A involves drilling 284 new CBM wells from 229 well pads within the Project Area. The companies also would construct the ancillary facilities needed to support these wells. The number of compressors required to implement this alternative increases significantly when compared with Alternative 1. Each of the horizontally drilled wells could require an 80-h.p. compressor to lift produced water and deliver gas into a sales pipeline.

Alternative 1B uses long- reach horizontal drilling, another technology currently undergoing testing in the Northern San Juan Basin (NSJB), to drill multiple locations from a single well pad. The tests of this technology in San Juan Basin Fruitland coals are limited to two experimental wells in La Plata County. Ex-

ploration companies are monitoring well production rates, costs, overall economics, and reliability of the well bore. Operational issues have led to further refinement and monitoring of this application. It is considered experimental within the basin at this time, and its application to field development would depend on the future success of the approach; it would be considered on an APD-by-APD basis.

The assumed horizontal distance from well pad to downhole target location is a maximum of 3,600 feet, based on experience in La Plata County (where two wells have been drilled to date). A single well pad of approximately 4 acres is used to drill four single-bore, long-reach wells. On average, one or fewer well pads per section access an area of approximately 1,280 acres per well pad. Horizontal drilling is to be used across the relatively undeveloped portions of the HD Mountains, where the technology can be applied to limit surface impacts. The locations of the well pads are dictated by constraints imposed by road access and the objective of effective reservoir management for optimal production. The technologies examined in Alternatives 1A and 1B could be applied to any of the alternatives that were considered in detail.

2.4.3 Alternative 2

Alternative 2 was developed specifically to respond to the assumption that the demand for natural gas would continue to increase for the near future. Alternative 2 differs from Alternative 1 only in scale. Under this alternative, the Companies would drill 522 CBM wells from 499 well pads and would construct 200 miles of access roads and pipelines. The Companies would construct up to seven additional disposal wells, 14 compressor stations at known locations, and five compressor stations at unknown locations. This alternative involves the same number of disposal wells as the Proposed Action because of the varying capacity of each disposal well and the number of operators in the area. Short-term disturbance would equal 1,851 acres, and long-term disturbance would equal 1,275 acres. This alternative would result in an 88 percent increase in long-term disturbance compared with Alternative 1.

2.4.4 Alternative 3

This alternative eliminates well development in the HD Mountains Inventoried Roadless Area, but otherwise presents the same pattern of development as Alternative 1. Under this alternative, the Companies would drill 212 CBM wells from 212 well pads. Unlike Alternatives 1 and 2, the Companies would drill no directional wells, however. The Companies would construct 75 miles of access roads and pipelines. They also would construct up to four disposal wells and seven compressor stations. This alternative would result in short-term disturbance of 740 acres, and long-term disturbance would total 468 acres. This alternative would result in a 31 percent decrease in long-term disturbance compared with Alternative 1.

2.4.5 Alternative 4

This alternative would continue gas development on BLM and NFS lands in the Project Area under the plans and analyses that currently guide gas development. This direction would allow for additional wells in the HD Mountains, on BLM-administered mineral estate in the western and central portions of the Project Area, and on state and private lands. Under this alternative, the Companies would drill 188 CBM wells from 188 well pads. Unlike Alternatives 1 and 2, the Companies would drill no directional wells, however. The Companies would construct 88 miles of access roads and pipelines. They also would construct up to two disposal wells and five compressor stations. Short-term disturbance would total 758 acres, and long-term disturbance would equal 474 acres. This alternative would result in a 30 percent decrease in long-term disturbance compared with Alternative 1.

2.4.6 Alternative 5 — No Action

NEPA requires that federal agencies evaluate a "No Action" alternative and use it as a baseline for comparing and measuring the effects of other alternatives that propose incrementally greater levels of development. The No Action alternative in this case means that BLM and FS would not authorize additional CBM development on federal leases within the Project Area. Drilling would continue on private and state leases, and BLM and FS would grant access across federal lands where other reasonable routes are not available to reach proposed state and fee wells. It is anticipated that industry would drill 118 wells from 118 well pads on non-federal leases with these federal restrictions in place. Again unlike Alternatives 1 and 2, the Companies would drill no directional wells. The Companies would construct 39 miles of access roads and pipelines. They also would construct four compressor stations. Short-term disturbance would equal 414 acres, and long-term disturbance would equal 248 acres, which is a decrease of 63 percent from the long-term disturbance that would occur under Alternative 1.

2.5 PAST, PRESENT, AND REASONABLY FORESEEABLE FUTURE ACTIVITIES

The general Cumulative Effects Analysis Area is defined as the Project Area (125,000 acres) and that portion of the Southern Ute Indian Tribe (SUIT) Reservation that has seen and will continue to experience CBM development over the next decade (422,000 acres). The Cumulative Effects Study Area for wildlife is therefore 547,000 acres, encompassing the Colorado portion of the San Juan Basin (SJB).

The cumulative-effects analysis considers the environmental consequences of conventional and CBM gas development across both study areas. It also considers other past, current, and projected actions and trends that may contribute synergistically to cumulative impacts. Each of the alternatives would contribute to cumulative wildlife impacts in the Colorado portion of the San Juan Basin. Other activities that have contributed and may contribute to cumulative impacts are rural and urban housing development, timber harvest, fire management, livestock grazing, recreation, agriculture, and road construction. These activities and the concerns they present are discussed below.

Oil and gas development is projected to continue both in and south of the Project Area. Industry's Proposed Action involves drilling 296 additional CBM wells over the next decade within the Project Area. South of the Project Area, within the bounds of the Southern Ute Reservation, 367 additional CBM infill wells, 70 injection wells for enhanced coal bed methane projects, and associated facilities are projected for Tribal minerals, and 586 wells are projected for non-Tribal minerals. Other reasonably foreseeable oil and gas development includes development in the New Mexico portion of the SJB (CBM, conventional gas, and oil). We do not predict wildlife movement and migration, however, between the Colorado and New Mexico portions of the San Juan Basin. Therefore, the cumulative wildlife effects analysis is focused on the Project Area and SUIT Reservation.

Community expansion continues to encroach on wildlife and habitats. In La Plata County, it is expected to include growth in the residential population; related increases in commercial operations and development of county roads; and small, industrial developments unrelated to mineral resources. No major industrial project, such as a power plant or new factory, is foreseen in La Plata County. Instead, community growth is expected in the form of an influx of individuals, families, and retirees attracted to the Four Corners-area lifestyle. Population will continue to be concentrated in Durango, Bayfield, and Ignacio, but residential development will also continue to encroach on agricultural and forested lands, especially in the central and northern parts of the county. Gas development is already spread throughout the area where the SJB overlaps the county.

The effects of timber harvest and fire suppression are of concern in the National Forest portion of the cumulative-effects area in the HD Mountains. Timber harvest, when taken in concert with other vegetation- or ground-disturbing activities such as oil and gas development, can impact wildlife and their habitats cumulatively. Records of past timber harvest activity indicate that between 1941 and 1996, 6,870 acres of ponderosa pine and mixed conifer was harvested in the Project Area on NFS land. Approximately 1,535 acres of ponderosa pine and Douglas-fir was converted by harvests to different vegetation types, including grasslands (103 acres), mountain shrub (55 acres), sagebrush (237 acres), Gambel oak (895 acres), piñon-juniper (214 acres), riparian (5 acres), and barren (26 acres). These treatments benefited early-successional wildlife species, to the detriment of those that thrive on older, forested ecosystems. Periodic timber harvests and thinning on small tracts of private and Reservation land contribute to maintaining younger age classes of ponderosa pine, as is the case on most of the SJNF.

A current SJNF timber sale straddles the northeastern border of the Project Area. Cutting activities began the summer of 2003. The Shamrock Timber Sale will commercially thin 157 acres of ponderosa pine. After harvest, a 500-acre prescribed burn is planned, to reduce fuels and enhance pine regeneration. Three additional vegetation-treatment projects are in various stages of planning. The Forest Service is reviewing ponderosa pine fuels-restoration treatments in the Fosset Gulch, Sauls Creek, and Lange Canyon areas. None of these activities is expected to affect FS sensitive species detrimentally, either individually or cumulatively. Indeed, each is designed to maintain the health and resilience of forested ecosystems. This is important when factoring in the effects of activities.

Fire suppression has been the overriding strategy for dealing with all fires in the Project Area since settlement in the late 1800s. This strategy has caused a somewhat unnatural mix of vegetation, in terms of structure and density. There are many more small-diameter trees and shrubs present today than there would be, had fire played a role in the last 100 years. Fire exclusion results in fewer, larger stems of Gambel oak, for example. This limits the moisture and sunlight available for grasses and forbs to grow. The changes in vegetation cover caused by fire suppression are an important consideration in terms of evaluating the cumulative impacts of management prerogatives and projects on FS sensitive species.

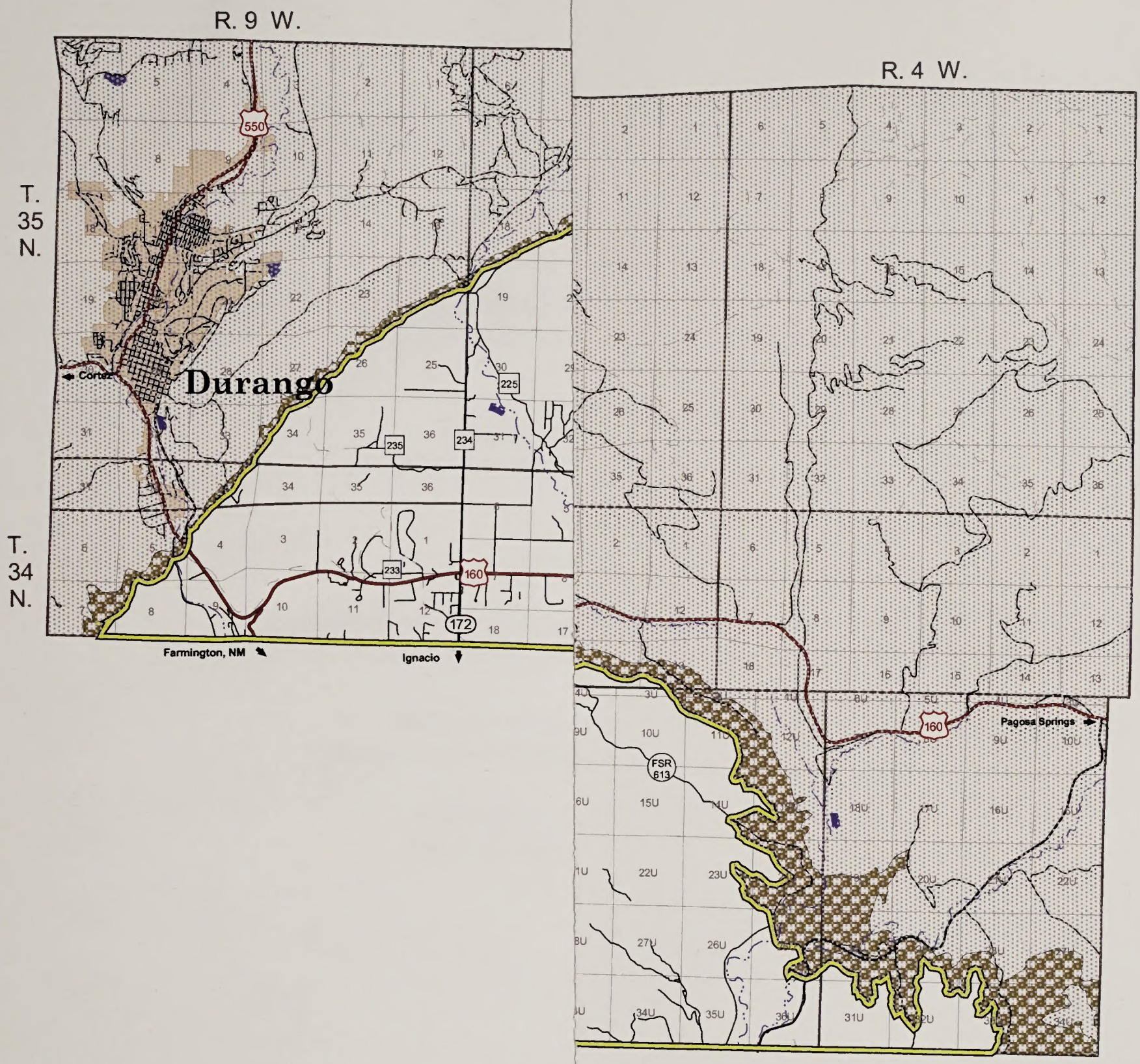
Somewhat offsetting these fire suppression effects are prescribed fires conducted in the HD Mountains over the past 16 years that treated close to 10,500 acres. The primary effect on vegetation was to top-kill Gambel oak. No significant changes in tree-canopy closure or density occurred because of these burns, and consequently there was no immediate effect, but we expect long-term benefits to MIS species from these projects.

The immediate Project Area includes all or part of six active cattle-grazing allotments and two closed grazing allotments. Allotments in the Project Area are managed with rotation grazing systems. Some allotments are used only 30 days in the spring; others the entire season, with deferment of pastures during certain periods of the growing season. Stock ponds, herding, salting, fencing, and geographical barriers are the primary means of controlling livestock distribution. Range monitoring shows an upward trend, in terms of species composition and cover, to the benefit of MIS.

A broad spectrum of recreation occurs year-round in the Project and cumulative-effects area. Summer activities include hiking, mountain biking, hunting, fishing, camping, sightseeing, ATV riding, and wildlife viewing. Both BLM and NFS lands are open seasonally to ATVs. Expansion of the road system, particularly on the National Forest, can attract additional motorized recreation use and would open up significantly more country than is currently accessed by roads. Areas easily accessible from Durango and Bayfield, such as Sauls Creek, are also expected to see increased day use for picnicking, hiking, mountain biking, and horseback riding, because of increases in nearby populations. Increased human use of the Project Area over time can result in wildlife harassment and, in the extreme, to habitat displacement. There is

no indication that that is occurring now, and control of human access to the Project Area must be considered in mitigating these wildlife concerns in the future.

The cumulative effects of other activities on private land, such as ranching and agriculture, cannot be quantified, because of a lack of formal study.



n Reservation

Legend

- Project Area Boundary
- U.S. Highway
- Primary Road
- Secondary Road
- Trail
- Lake/Reservoir
- Stream/River
- Municipal Area
- Fruitland Formation Outcrop

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Study, 1998.
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NORTHERN SAN JUAN BASIN CBM PROJECT BIOLOGICAL EVALUATION	
FIGURE 1 PROJECT AREA	
ANALYSIS AREA: LA PLATA & ARCHULETA COUNTIES, COLORADO	
Date: 09/12/03	ArcView File: C:\994-sanjuan\wildlife-ba.apr
	Prepared By: JG

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The cumulative effects of other activities on private land, such as ranching and agriculture, cannot be quantified, because of a lack of formal study.

R. 9 W. R. 8 W. R. 7 W. R. 6 W. R. 5 W. R. 4 W.

T. 35 N.

T. 34 N.

Durango

Bayfield

Gem Village

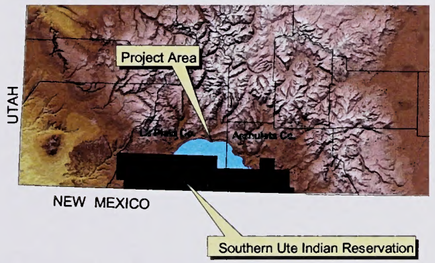
Farmington, NM

Ignacio

Pagosa Springs

LA PLATA COUNTY / ARCHULETA COUNTY

Southern Ute Indian Reservation



Legend

- Project Area Boundary
- U.S. Highway
- Primary Road
- Secondary Road
- Trail
- Lake/Reservoir
- Stream/River
- Municipal Area
- Fruitland Formation Outcrop

2 0 2 4 6 8 *Kilometers*

2 0 2 4 6 8 *Miles*

La Plata County transportation data provided by the La Plata County Transportation Study, 1998. Hydrologic and Archuleta County transportation features extracted from 1:100,000 USGS SDTS data.

Transverse Mercator Projection
1927 North American Datum
Zone 13

NORTHERN SAN JUAN BASIN CBM PROJECT
BIOLOGICAL EVALUATION

FIGURE 1
PROJECT AREA

ANALYSIS AREA: LA PLATA & ARCHULETA COUNTIES, COLORADO

Date: 09/12/03	ArcView File: C:\994-sanjuan\wildlife-ba.apr
	Prepared By: JG

BIOLOGICAL EVALUATION

NORTHERN SAN JUAN BASIN COAL BED METHANE DEVELOPMENT ENVIRONMENTAL IMPACT STATEMENT

February 04, 2004

United States Department of Agriculture
Forest Service

San Juan Public Lands
Archuleta and La Plata Counties

Prepared by:

Anthony Garcia, District/Field Office Wildlife Biologist
Columbine Ranger District/Field Office

Matt Schweich, Senior Ecologist
Greystone Environmental Consultants, Inc.

Jeff Redders, Forest Ecologist
San Juan Public Lands Center

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Figure 1 Project Area 15

3.0 SPECIES CONSIDERED AND SPECIES EVALUATED

3.1 SPECIES CONSIDERED BUT ELIMINATED FROM DETAILED EVALUATION

All FS Region 2 sensitive species that potentially occur on the SJNF were evaluated for their potential to occur in the Project Area. This evaluation concluded that 18 of these species (Table 1) are not expected to occur because the Project Area is either outside of their range or does not contain any potential habitat. This group of species would not be affected by the proposed project, and a determination of "No impact" is appropriate. Therefore, these species have been eliminated from further detailed evaluation. The rationale for this elimination is discussed for each species below.

3.1.1 Southern Maidenhair Fern

Southern maidenhair fern is known to occur in Baca, Las Animas, Mesa, Moffat, Montezuma, and Montrose Counties (Spackman et al. 1997). The closest known occurrence in Montezuma County is 40 miles southwest of the Project Area. A survey by Ladyman (2002) on 24 proposed CBM well sites within NSF lands did not reveal any suitable moist rock habitat for this species. Therefore, this species is not expected to occur based on the distance between known occurrences and the Project Area, the absence of recorded occurrences in the Project Area, and the absence of dripping cliffs and seeps suitable habitat.

3.1.2 Reflected Moonwort

Reflected moonwort occurs in Boulder, Clear Creek, Conejos, El Paso, Grand, Gilpin, Gunnison, Lake, Larimer, Park, San Juan, and Teller Counties. There are no known occurrences of this species in the Project Area. The closest known occurrence is in San Juan County, 20 miles north of Durango. It is found on gravelly soils, rocky hillsides, grassy slopes, and meadows at elevations between 9,500 and 11,000 feet (Spackman et al. 1997). A survey by Ladyman (2002) on 24 proposed CBM well sites within NSF lands did not reveal any suitable habitat for this species. Reflected moonwort is not expected to occur based on the distance between known occurrences and the Project Area and because the Project Area does not meet the elevational requirements for this species.

3.1.3 Pale Moonwort

Pale moonwort is known to occur in Boulder, Conejos, Gunnison, Larimer, Park, San Juan, and Teller Counties. There are no known occurrences of this species in the Project Area; the closest known occurrence is in San Juan County, 20 miles north of Durango. It is found on open exposed hillsides, burned or cleared areas, and old mining sites at elevations between 9,800 and 10,600 feet (Spackman et al. 1997). A survey by Ladyman (2002) on 24 proposed CBM well sites within NSF lands did not reveal any suitable habitat for this species. Pale moonwort is not expected to occur based on the distance between known occurrences and the Project Area and because the Project Area does not meet the elevational requirements for this species.

3.1.4 Altai Cotton-grass

Altai cotton-grass is known to occur in Eagle, Gunnison, Hinsdale, La Plata, Park, and San Juan Counties. The closest known location is near the border between San Juan and La Plata Counties, 20 miles north of the Project Area. It is found in fens, a type of wetland, at elevations between 9,500 and 14,000 feet (Spackman et al. 1997). A survey by Ladyman (2002) on 24 proposed CBM well sites within NSF lands

did not reveal any suitable habitat for this species. Altai cotton-grass is not expected to occur based on the distance between known occurrences and the Project Area and because the Project Area does not meet the elevational requirements of this species.

3.1.5 Colorado Tansy-aster

Colorado tansy-aster is known to occur in Gunnison, Hinsdale, La Plata, Lake, Mineral, Park, Pitkin, Saguache, and San Juan Counties (Spackman et al. 1997). There are no known occurrences of this species in the Project Area, and the nearest known location is 15 miles north of Durango. A survey by Ladyman (2002) on 24 proposed CBM well sites within NSF lands did not reveal any suitable habitat for this species. This species is not expected to occur based on the distance between known occurrences and the Project Area.

3.1.6 American Marten

In Colorado, the American marten occupies the higher mountains in a region roughly equivalent to the distribution of spruce/fir and lodgepole pine forests, including the San Juan Mountains immediately north of the Project Area (Fitzgerald et al. 1994). This species is not known to inhabit the Project Area, nor is it expected to occur based on the small, fragmented nature of suitable habitat patches.

3.1.7 Wolverine

The wolverine primarily occurs in the boreal forests of Canada and Alaska. It is also present at very low densities at the higher elevations of mountain ranges throughout the western United States. Historically, this species occurred at higher elevations of the Rocky Mountains in Colorado, including the San Juan Mountains. The status of the Colorado population is uncertain at present, however. Recent studies by the Colorado Division of Wildlife (CDOW) have failed to find definitive evidence of wolverines (Fitzgerald et al. 1994). This species is not expected to occur in the Project Area based on a lack of suitable habitat.

3.1.8 Common Loon

The common loon is a rare spring and fall migrant in western Colorado. Individuals in both breeding and non-breeding plumage are rarely seen in Colorado in the summer. Breeding is not suspected in Colorado; the nearest known breeding area is in the mountains of northwestern Wyoming (Andrews and Righter 1992). They prefer large reservoirs and lakes for breeding and foraging. The common loon is not expected to occur in the Project Area based on the rare occurrence of the species in Colorado and the general lack of preferred habitats.

3.1.9 Ferruginous Hawk

The ferruginous hawk breeds in the interior of western North America, including the Great Plains. It winters primarily from the central and southern parts of its breeding range south to Mexico (DeGraaf et al. 1991). For Colorado, Andrews and Righter (1992) considered the species a resident that was common in winter on the eastern plains and rare or uncommon in other areas and seasons. This species is considered a non-breeder and an occasional winter visitor in the SJNF. There are no known ferruginous hawk nests in or near the Project Area, nor are any expected.

3.1.10 Osprey

Ospreys are neotropical migrants that winter in the southern U.S., Mexico, and south to Chile and northern Argentina (DeGraaf et al. 1991). They breed throughout much of North America where preferred habitats are available. As of 1992 there were at least 15 confirmed or probable breeding records in Colorado at an elevation range of 8,000 to 10,000 feet (Andrews and Righter 1992). These sites are in the mountains nearly statewide, but are concentrated in the northern half of the state. The largest concentration is at reservoirs in eastern Grand County. There are at least four nesting sites within the SJNF boundary. Osprey have been observed at McPhee Reservoir during the summer months and, though no nest site has been identified, it is assumed that there is a nest within the area. There are other known nesting sites at Electra Lake north of Durango and at Williams Reservoir northwest of Pagosa Springs. Additionally, there is a known nesting site on the Southern Ute Indian Reservation on the Pine River, south of the project area (Karron 2001). There are no known osprey nesting sites in the Project Area, nor are any expected based on the minimal amount of available breeding habitat.

3.1.11 Columbian Sharp-tailed Grouse

The Columbian sharp-tailed grouse historically occurred west of the Continental Divide in Colorado from Archuleta, La Plata, and Montezuma Counties north along the Western Slope into Wyoming. By the early 1990s, the species was restricted to Mesa, Moffat, Rio Blanco, and Routt Counties. Currently, Moffat, Rio Blanco, and Routt Counties are known to be occupied by most, if not all, of the remaining Columbian sharp-tailed grouse in Colorado. It is also possible that a few birds remain on the Uncompahgre Plateau in Mesa County (Barrett 1998a). This species is not expected to occur in the Project Area.

3.1.12 American Bittern

The American bittern breeds throughout the western United States and across the northern states to the east. This species winters along the East and West Coasts, the lower Colorado River valley and the Gulf Coast states into Mexico. Within Colorado, the South Platte and Arkansas River valleys and the San Luis Valley provide primary breeding areas (Yaeger 1998). Other breeding sites are scattered across the state and include North Park, the Yampa River valley, and Browns Park National Wildlife Refuge. The San Luis Valley appears to support the largest breeding group in the state. Despite a widespread distribution, the bittern does not appear to be common anywhere in the state. It has been estimated that there are only several hundred breeding pairs in the state (Kingery 1998). This species has been documented to breed near Durango, just outside the project area (Andrews and Righter 1992). There are no known American bittern nesting sites in the Project Area, nor are any expected based on the minimal amount of available breeding habitat.

3.1.13 White-faced Ibis

The white-faced ibis breeds from central Mexico to Louisiana and Texas (along the Gulf Coast) and throughout the Great Basin, with scattered breeding colonies in other western states and in the upper Midwest. Wintering populations occur along the Gulf Coast of Texas and Louisiana, in the valleys of California, and in Mexico. In Colorado, most breeding pairs inhabit wetlands in the San Luis Valley, although breeding has also been documented at scattered locations that include northwest Colorado (Brown's Park), the Gunnison Basin, Cortez, and several reservoirs on the eastern plains (Ryder 1998a). Individuals that breed in Colorado are thought to winter in Texas and Mexico. Breeding white-faced ibises in Colorado appear to prefer wetlands with tall emergent vegetation, including cattails and bulrushes. There are no known nest sites in the Project Area, nor are any expected based on the minimal amount of available breeding habitat.

3.1.14 Greater Sandhill Crane

Greater sandhill cranes occur throughout the western United States and breed in Colorado from Mesa County northward. La Plata County is within the historical distribution of breeding sandhill cranes, but no breeding has been documented in recent decades (Barrett 1998b). Nest sites are closely associated with a variety of wet habitats, including ponds, marshes, and wetlands. The San Luis Valley east of the Project Area is an important staging area during seasonal migration. The sandhill crane is not expected to occur in the Project Area, with the exception of a possible rare migrant, because it is outside of the breeding range of this species.

3.1.15 Western Yellow-billed Cuckoo

Historically, the yellow-billed cuckoo occurred throughout the United States, with the western subspecies found west of the Continental Divide, including western Colorado. Records indicate that this species was probably never common in western Colorado, however. The cuckoo selects old-growth riparian forests with dense understories for breeding. There have been no recent breeding records in southwestern Colorado, including the Project Area (Carter 1998). This species is not expected to occur in the Project Area based on the lack of known occurrences in this part of Colorado.

3.1.16 Boreal Owl

The boreal owl is a medium-sized owl of circumboreal distribution. In the western United States, it is limited to subalpine forests dominated by subalpine fir and Engelmann spruce in the Rocky Mountains, Blue Mountains, and northern Cascade Range. This species is most often found in at 9,000 to 10,500 feet in elevation mature spruce/fir or spruce/fir/lodgepole forests interspersed with meadows. Individuals occasionally move to lower elevations after the breeding season. This species has been documented to breed in the San Juan Mountains, 10 miles north of the Project Area (Ryder 1998b). This species is not, however, expected to breed in the Project Area based on a lack of preferred breeding habitats. Post-breeding individuals may rarely move into the upper elevations of the Project Area, although such an occurrence has not been documented.

3.1.17 Boreal Toad

The boreal toad ranges throughout much of western North America except for the arid Southwest. It occurs throughout the mountainous portion of Colorado, with the exception of the Sangre de Cristo Range, Wet Mountains, and Pikes Peak region. These toads are most commonly found between 8,500 and 11,000 feet, and have been found only rarely as low as 7,000 feet (Hammerson 1999). Historical records indicate the presence of this species at Divide Lakes, Williams Lake, and Monument Lake, which lie within the Weminuche Wilderness Area on the SJNF. Two breeding sites have been found on the Divide District of the Rio Grande National Forest. Both were active in 1996, but only one was active in 1997. There are no historical or current records that this species inhabits the Project Area. Most of the Project Area lies below the lower limit of the elevational range of this species, although a small area in the eastern part of the range lies above this limit. This species is not expected to occur in the Project Area in light of the minimal amount of suitable habitat available and the lack of historical and current records of occurrence.

3.1.18 Colorado River Cutthroat Trout

Historically, the Colorado River cutthroat trout (CRCT) occurred in most waters of the upper Colorado River basin. Its natural distribution is assumed to be bounded to the west by the Dirty Devil River of Utah and to the south by the San Juan River (Behnke 1992). CRCT survive in several isolated headwater tribu-

taries of the San Juan River outside of the Project Area, but are not known to occur in the Project Area. This species is not expected to occur in the Project Area based on a lack of suitable habitat.

3.2 SPECIES EVALUATED IN DETAIL

The remaining FS Region 2 sensitive species may occur in the Project Area based on known occurrences of, or the presence of suitable habitats for, these species. The potential effects of the proposed project on these species are evaluated in detail in the following sections. General information about each species is reviewed, including its status, distribution, life history, and factors of concern. The environmental baseline includes a summary of past and present effects of federal, state, and private actions and other human activities in the Project Area (including past and on-going CBM development) on each species. Potential effects from each alternative and an impact determination for each species are analyzed. The analysis of direct effects to sensitive species pertains to lands administered by the FS in the Project Area. The cumulative effects analysis of the same species pertains to a larger area, including the entire Project Area and the study area for the oil and gas development on the Southern Ute Indian Reservation EIS (SUIT EIS) (BLM et al. 2002). Additional mitigation measures beyond any that are integral to the proposed project also are discussed.

For species evaluated in detail, Table 3 presents associations between species and habitats used for this analysis. Table 4 lists the extent and proportion of suitable habitats on NFS lands in the Project Area for each species evaluated in detail. Table 5 presents the extent and proportion of impacts to those suitable habitats for each species. Table 6 presents the extent and proportion of cumulative effects to suitable habitats by alternative for each species.

3.2.1 Aztec Milkvetch

Species Information

Status

The Aztec milkvetch is classified as a sensitive species by Region 2 of the FS.

Distribution

The Aztec milkvetch is found in Colorado and New Mexico. In Colorado, it has been found in La Plata and Archuleta Counties. This species has been found in two locations within the Project Area, both of which are partially on NFS land. Several other occurrences of this species are in close proximity to the Project Area (Colorado Natural Diversity Information Source 2002). Other undocumented occurrences of this species may also exist in unsurveyed portions of the Project Area based the presence of substantial areas of suitable habitat. A botanical survey conducted by Ladyman (2002) on 24 proposed CBM well sites within NSF lands did not specifically identify any Aztec milkvetch, but due to drought conditions, their presence or absence could not be definitively ruled out. Therefore, Ladyman (2002) concluded that suitable habitat was observed for this species.

Within the Project Area, 11,007 acres of sagebrush and pinyon-juniper community types on NFS lands may be suitable for the Aztec milkvetch (Table 4).

TABLE 3 SPECIES HABITAT ASSOCIATIONS

Species	Grassland	Sagebrush	Pinyon-Juniper	Mountain Shrub	Gambel Oak	Ponderosa Pine	Mixed Conifer	Aspen	Riparian/ Wetland	Barren	Water
Aztec milkvetch		X	X								
Giant helleborine									X		
Pagosa skyrocket			X		X	X				X	
Pagosa Springs bladderpod	X		X		X	X[1]	X[1]			X	
Dwarf shrew		X	X	X	X	X	X	X	X		
Spotted bat	X	X	X	X	X	X[1]	X[1]	X[1]	X	X	
Townsend s big-eared bat	X	X	X	X	X	X[1]	X[1]	X[1]	X	X	
Ringtail			X	X	X	X			X	X	
Northern goshawk						X[2]	X[2]	X[2]			
Merlin	X	X	X	X		X	X	X	X	X	
Western burrowing owl	X	X								X	
Flammulated owl			X			X	X	X			
Lewis woodpecker	X	X	X	X	X	X[1]			X		
Three-toed woodpecker						X	X	X			
Olive-sided flycatcher						X	X	X	X		
Purple martin						X	X	X	X		
Pygmy nuthatch						X	X	X	X		
Golden-crowned kinglet			X			X	X		X		
Loggerhead shrike	X	X	X							X	
Fox sparrow							X		X		
Tiger salamander									X		X
Northern leopard frog									X		X
Milk snake	X	X	X	X	X	X				X	

1 Excluding habitat structural stages: 3B, 3C, 4B, 4C, and 5.
2 Including only habitat structural stages 3A, 3B, 3C, 4A, 4B, 4C, and 5.

TABLE 4 HABITAT AVAILABILITY FOR SPECIES CONSIDERED IN DETAIL		
Species	Acres of Suitable Habitat on NFS Land within the Project Area	Percentage of NFS Land within Project Area that is Suitable Habitat
Aztec milkvetch	11,007	22%
Giant helleborine	26	<1%
Pagosa skyrocket	38,725	78%
Pagosa Springs bladderpod	22,998	47%
Dwarf shrew	46,078	93%
Spotted bat	24,819	50%
Townsend s big-eared bat	24,819	50%
Ringtail	39,188	79%
Northern goshawk	11,831	24%
Merlin	39,642	80%
Western burrowing owl	4,678	9%
Flammulated owl	34,501	70%
Lewis woodpecker	24,723	50%
Three-toed woodpecker	24,852	50%
Olive-sided flycatcher	24,878	50%
Purple martin	24,878	50%
Pygmy nuthatch	24,878	50%
Golden-crowned kinglet	33,273	67%
Loggerhead shrike	14,327	29%
Fox sparrow	4,382	9%
Tiger salamander	28	<1%
Northern leopard frog	28	<1%
Milk snake	43,762	89%

TABLE 5 SUITABLE HABITAT AFFECTED BY EACH ALTERNATIVE ON NFS LANDS

Species	Alternative 1		Alternative 1A		Alternative 1B		Alternative 2		Alternative 3		Alternative 4		Alternative 5	
	Acres of Suitable Habitat Affected	Percent of Suitable Habitat Affected	Acres of Suitable Habitat Affected	Percent of Suitable Habitat Affected	Acres of Suitable Habitat Affected	Percent of Suitable Habitat Affected	Acres of Suitable Habitat Affected	Percent of Suitable Habitat Affected	Acres of Suitable Habitat Affected	Percent of Suitable Habitat Affected	Acres of Suitable Habitat Affected	Percent of Suitable Habitat Affected	Acres of Suitable Habitat Affected	Percent of Suitable Habitat Affected
Aztec milkvetch	136	1%	73	<1%	80	<1%	234	2%	88	<1%	99	<1%	11	<1%
Giant helleborine	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%
Pagosa skyrocket	573	1%	351	<1%	265	<1%	941	2%	307	<1%	337	<1%	83	<1%
Pagosa Springs bladderpod	436	2%	240	1%	115	<1%	806	4%	218	<1%	281	1%	46	<1%
Dwarf shrew	672	2%	422	<1%	297	<1%	1,075	2%	353	<1%	379	<1%	88	<1%
Spotted bat	411	2%	259	1%	133	<1%	858	3%	246	<1%	287	1%	48	<1%
Townsend's big-eared bat	411	2%	259	1%	133	<1%	858	3%	246	<1%	287	1%	48	<1%
Ringtail	675	2%	353	<1%	265	<1%	950	2%	307	<1%	340	<1%	83	<1%
Northern goshawk	368	3%	324	3%	262	2%	397	3%	214	2%	210	2%	38	<1%
Merlin	615	2%	377	1%	298	<1%	915	2%	369	<1%	352	<1%	86	<1%
Western burrowing owl	78	2%	43	<1%	44	<1%	98	2%	68	1%	36	<1%	4	<1%
Flammulated owl	455	2%	332	1%	254	<1%	801	2%	299	<1%	313	<1%	81	<1%
Lewis' woodpecker	455	2%	255	1%	197	<1%	821	3%	242	<1%	272	1%	48	<1%
Three-toed woodpecker	423	2%	276	1%	191	<1%	590	2%	234	<1%	217	<1%	72	<1%
Olive-sided flycatcher	423	2%	276	1%	191	<1%	590	2%	234	<1%	217	<1%	72	<1%
Purple martin	423	2%	276	1%	191	<1%	590	2%	234	<1%	217	<1%	72	<1%
Pygmy nuthatch	423	2%	276	1%	191	<1%	590	2%	234	<1%	217	<1%	72	<1%
Golden-crowned kinglet	523	2%	320	1%	244	<1%	776	2%	299	<1%	311	<1%	81	<1%
Loggerhead shrike	190	1%	98	<1%	107	<1%	316	2%	133	<1%	127	<1%	14	<1%
Fox sparrow	65	1%	41	<1%	10	<1%	84	2%	22	<1%	39	<1%	3	<1%
Tiger salamander	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%
Northern leopard frog	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%
Milk snake	649	1%	395	<1%	304	<1%	1,048	2%	375	<1%	371	<1%	88	<1%

TABLE 6 CUMULATIVE EFFECTS TO SUITABLE HABITAT BY ALTERNATIVE

Species	Alternative 1		Alternative 1A		Alternative 1B		Alternative 2		Alternative 3		Alternative 4		Alternative 5	
	Acres of Suitable Habitat Affected	Percent of Suitable Habitat Affected	Acres of Suitable Habitat Affected	Percent of Suitable Habitat Affected	Acres of Suitable Habitat Affected	Percent of Suitable Habitat Affected	Acres of Suitable Habitat Affected	Percent of Suitable Habitat Affected	Acres of Suitable Habitat Affected	Percent of Suitable Habitat Affected	Acres of Suitable Habitat Affected	Percent of Suitable Habitat Affected	Acres of Suitable Habitat Affected	Percent of Suitable Habitat Affected
Aztec Milkvetch	14,050	5.4	13,987	5.3	13,995	5.3	14,226	5.4	14,001	5.3	14,009	5.3	13,914	5.3
Giant Helleborine	495	5.6	495	5.7	495	5.6	495	5.6	495	5.6	495	5.6	495	5.6
Pagosa Skyrocket	11,228	4.3	11,007	4.2	10,917	4.2	11,774	4.5	10,965	4.2	10,992	4.2	10,718	4.1
Pagosa Springs bladderpod	15,330	5.1	15,193	4.7	15,148	5.0	15,750	5.2	15,190	5.0	15,236	5.1	15,050	5.0
Dwarf shrew	18,019	4.8	17,768	4.7	17,639	4.7	18,653	4.9	17,702	4.7	17,728	4.7	17,416	4.6
Spotted bat	22,131	5.3	21,988	5.0	21,941	5.3	22,618	5.5	21,991	5.3	22,021	5.3	21,827	5.3
Townsend's big-eared bat	22,131	5.3	21,988	5.0	21,941	5.3	22,618	5.5	21,991	5.3	22,021	5.3	21,827	5.3
Ringtail	12,851	4.5	12,629	4.4	12,537	4.3	13,429	4.7	12,587	4.4	12,616	4.4	12,339	4.3
Northern goshawk	896	3.3	854	3.2	790	2.9	959	3.6	742	2.8	739	2.8	712	2.7
Merlin	22,914	5.2	22,675	4.9	22,595	5.1	23,444	5.3	22,672	5.1	22,652	5.1	22,371	5.2
Western burrowing owl	10,847	6.1	10,812	6.0	10,812	6.0	10,956	6.1	10,839	6.1	10,806	6.0	10,772	6.0
Flammulated owl	10,444	4.5	10,240	4.4	10,163	4.3	10,834	4.6	10,211	4.4	10,223	4.4	9,978	4.3
Lewis' woodpecker	22,043	5.4	21,902	5.0	21,850	5.3	22,503	5.5	21,905	5.3	21,932	5.5	21,744	5.3
Three-toed woodpecker	1,572	2.7	1,425	2.5	1,340	2.3	1,813	3.2	1,387	2.4	1,372	2.4	1,220	2.1
Olive-sided flycatcher	2,067	3.1	1,920	2.9	1,835	2.8	2,307	3.5	1,882	2.8	1,867	2.8	1,714	2.6
Purple martin	2,067	3.1	1,920	2.9	1,835	2.8	2,307	3.5	1,882	2.8	1,867	2.8	1,714	2.6
Pygmy nuthatch	2,067	3.1	1,920	2.9	1,835	2.8	2,307	3.5	1,882	2.8	1,867	2.8	1,714	2.6
Golden-crowned kinglet	10,925	4.5	10,723	4.4	10,647	4.2	11,301	4.7	10,705	4.4	10,715	4.4	10,473	4.3
Loggerhead shrike	19,719	5.5	19,627	5.5	19,634	5.5	19,997	5.6	19,663	5.5	19,656	5.5	19,530	5.5
Fox sparrow	560	4.2	536	4.0	504	3.8	584	4.4	517	3.9	533	4.0	498	3.7
Tiger salamander	496	5.5	496	5.5	496	5.5	496	5.5	496	5.5	496	5.5	496	5.5
Northern leopard frog	496	5.5	496	5.5	496	5.5	496	5.5	496	5.5	496	5.5	496	5.5
Milk snake	23,115	5.1	22,861	5.0	22,764	5.0	23,791	5.2	22,846	5.0	22,840	5.0	22,534	4.9

Life History

The Aztec milkvetch occurs at an elevation of 5,400 to 7,300 feet on mesas, bluffs, and low hills in sandy, often alkaline clay soils derived from the Lewis and Mancos shales. It is generally found in association with junipers, but sometimes with sagebrush. Flowering occurs between late-April and mid-July (Spackman et al. 1997).

Factors of Concern

Activities that would create a surface disturbance such as construction of well pads and roads within occupied habitat are of concern for this species because of the potential for degradation or loss of habitat and destruction of individuals or entire occurrences of this species.

Environmental Baseline

There have been no CBM-related impacts to known occurrences. Undocumented occurrences may have been affected by existing CBM development; however, there are no data to make that determination.

Activities that could affect the species include loss of habitat caused by road building, residential development, and agricultural clearing of land and degradation of habitat because of these same factors, off-road vehicle (ORV) use, and livestock grazing.

Effects of the Alternatives

Alternatives 1, 1A, 1B, 2, and 3 propose the same number and type of wells and facilities near known occurrences of this species. Alternatives 4 and 5 involve construction of fewer wells and facilities near known occurrences. The types of effects to this species are the same among the alternatives and vary only according to the amount of habitat disturbed by each alternative. In general, alternatives that involve more wells and facilities (for example, Alternative 2) are more likely to affect this species and its habitats than are alternatives with fewer wells and facilities (for example, Alternative 5). Table 5 summarizes the amount of disturbance to suitable habitats for Aztec milkvetch by alternative. Alternative 2 would disturb 2 percent (234 acres) of the suitable habitats on NFS lands in the Project Area, the most by any alternative. Alternative 1 would disturb 1 percent of milkvetch habitat on NFS lands, and Alternatives 1A, 1B, 3, 4, and 5 would disturb less than 1 percent of the habitats on NFS lands (Table 5).

Potential effects to the Aztec milkvetch include injury or death to individuals as a result of trampling or crushing by machinery, disturbance, or destruction of habitats, and introduction of non-native species. These same activities may also result in disturbance or destruction of habitats by altering surface soil conditions, altering the local hydrologic regime, and creating erodible conditions. Disturbance to habitats may also create conditions that are conducive to establishment of non-native plant species. Many non-native plant species can out-compete native species for habitat resources, which could lead to reduction in numbers and possible local extinction of this species.

Within the cumulative effects analysis area, 262,450 acres of sagebrush and pinyon-juniper habitats are suitable for the Aztec milkvetch. Depending on alternative, between 13,915 and 14,227 acres of these habitats would be cumulatively disturbed by past activities, the alternatives, and the alternative selected for the SUIT EIS. The cumulative disturbance to these habitats accounts for 5.3 to 5.4 percent of this vegetation type in the cumulative effects analysis area. These relative percentages indicate the extent of potential cumulative effects to this species habitat. Mitigation measures designed to avoid effects to Aztec milkvetch from all project activities would be implemented and would minimize the potential for any cumulative effects to this species on federal jurisdiction.

Other cumulative effects, although difficult to quantify, could be caused by activities on private and state lands, such as sand and gravel mining, livestock grazing, agriculture, road construction, and rural and urban housing development. Some of these activities would occur in habitats that may support the Aztec milkvetch. The extent of these impacts, and the potential for them to affect this species, are not quantifiable. Specific mitigation measures are described in the EIS that apply to sensitive species and are listed in Section 2.3.2, Project Design Recommendations, of this BE. The following specific mitigation measures apply to the Aztec milkvetch:

- Minimize the number and length of new access roads.
- Implement a travel management plan on NFS lands that shifts roads currently designated as open to motorized use to a closed designation to help reduce adverse indirect impacts from disturbance.
- Minimize disturbance by clearing and otherwise disturbing only vegetation within the minimum area needed for safe and efficient development, production, and maintenance. Extra efforts should be used to avoid disturbance of stands of old-growth ponderosa pine.
- Conduct preconstruction surveys for Aztec milkvetch in all potential areas of disturbance that are identified as suitable habitat during the pre-construction phase of the project.
- Avoid individuals and populations of Aztec milkvetch that may be affected by activities.

Determination

Implementation of any of the alternatives as described above, **may adversely impact individuals, but is not likely to result in a loss of viability on the planning area, nor cause a trend toward federal listing or a loss of species viability range wide** for the Aztec milkvetch. This determination is based on the low likelihood that this species occurs within the Project Area, the implementation of pre-construction surveys in suitable habitats that would be disturbed by each of the alternatives and the implementation of avoidance measures if new occurrences are discovered.

Additional Recommendations or Mitigation Measures

Pre-construction surveys for Aztec milkvetch will occur in between April 15 and July 31 when the species is most likely to be flowering.

3.2.2 Giant Helleborine

Species Information

Status

The giant helleborine is classified as a sensitive species by Region 2 of the FS and the BLM in the State of Colorado.

Distribution

This species occurs in Archuleta, Chaffee, Delta, Mesa, Moffat, Montezuma, Montrose, and Saguache counties. There are no documented occurrences of this species in the Project Area. A survey by Ladyman (2002) concluded that on 24 proposed CBM well sites within NSF lands, areas were not consistently wet enough to support suitable habitat for this species. However, this species may occur in the Project Area because of the presence of potential habitats and the proximity of known occurrences to the Project Area. Within the Project Area, 26 acres of riparian/wetland community type on NFS lands may be suitable for this species (Table 4).

Life History

The giant helleborine grows up to 100 centimeters tall and has greenish or purplish flowers that appear from June to July. It occurs at elevations of 4,800 to 8,000 feet. The habitat includes seeps on sandstone cliffs and hillsides, springs, and sometimes hot springs (Spackman et al. 1997).

Factors of Concern

Development in and around springs, including hot springs, as well as orchid collecting by hobbyists, can be contributing factors in the rarity of this species. Any surface disturbing activity in occupied habitat could be detrimental to individuals. Alterations of groundwater or surface water hydrology may affect habitats occupied by this species.

Environmental Baseline

There are no documented CBM-related impacts to this species. There is the potential for undocumented occurrences to have been affected by existing CBM development.

Effects of the Alternatives

Alternatives 1, 1A, 1B, 2, and 3 propose the same number and type of wells and facilities. Alternatives 4 and 5 involve construction of fewer wells and facilities. The types of effects to this species, if it exists in the Project Area, are the same among the alternatives and vary only according to the amount of habitat disturbed by each alternative. In general, alternatives that involve more wells and facilities (for example, Alternative 2) are more likely to affect this species and its habitats than are alternatives with fewer wells and facilities (for example, Alternative 5). Table 5 summarizes the amount of disturbance to suitable habitats for giant helleborine by alternative. None of the alternatives is predicted to cause disturbance to habitat suitable for the giant helleborine, since there are no known occurrences on NFS lands in the Project Area.

Potential effects to the giant helleborine include alteration of suitable habitats and increased collection by hobbyists. Disturbance to occupied habitat and individual plants, including trampling or crushing, is not expected because pre-construction surveys and avoidance measures, such as buffer zones, would be implemented. Suitable habitats may be degraded or destroyed by alteration of groundwater flows that form the seep and spring habitats for the species. If the water flow at seeps and springs were reduced, the amount and quality of these habitats would be reduced. These habitats would become less suitable for the giant helleborine and in some cases may no longer support the species. The extent of this impact is difficult to predict because there are no known occurrences of the species in the Project Area, but would be essentially the same for all alternatives.

Within the cumulative effects analysis area, 8,829 acres riparian/wetland habitats are suitable for the giant helleborine. Cumulatively, the combination of past oil and gas activities, the alternatives, and the selected alternatives for the SUIT EIS would disturb 495 acres of giant helleborine habitat. The cumulative disturbance to these habitats accounts for 5.6 percent of this vegetation type in the cumulative effects analysis area. Although it is unlikely that most of these habitats support the giant helleborine, this analysis indicates the extent of potential cumulative effects to this species and its habitat. In addition to habitat loss, past and proposed project actions may alter or degrade the quality or quantity of surface water. Implementation of the proposed project may alter local groundwater flows to the extent that it may reduce the availability and suitability of habitats for giant helleborine in the cumulative effects analysis area. Activities on private lands, such as sand and gravel mining, livestock grazing, agriculture, road construction, and rural and urban housing development, may occur in habitats that support the giant helleborine. The extent of these impacts, and the potential for them to affect this species, are not quantifiable.

On federal jurisdiction, mitigation measures designed to avoid effects to giant helleborine from all project activities would be implemented and would minimize the potential for cumulative effects to this species. Specific mitigation measures are described in the EIS that apply to sensitive species and are listed in Section 2.3.2, Project Design Recommendations, of this BE. The following specific mitigation measures apply to the giant helleborine:

- Minimize the number and length of new access roads.
- Minimize disturbance by clearing and otherwise disturbing only vegetation within the minimum area needed for safe and efficient development, production, and maintenance. Extra efforts should be used to avoid disturbance of stands of old-growth ponderosa pine.
- Locate well pads, compressors, and other non-linear facilities outside of riparian areas, wetlands, and floodplains to protect the biological and hydrologic features.
- Conduct preconstruction surveys for giant helleborine in all potential areas of disturbance that are identified as suitable habitat during the pre-construction phase of the project.
- Avoid individuals and populations of giant helleborine that may be affected by activities.

Determination

Implementation of any of the alternatives, as described above, **may adversely impact individuals, but is not likely to result in a loss of viability on the planning area, nor cause a trend toward federal listing or a loss of species viability range wide** for the giant helleborine. This determination is based on the low likelihood that this species occurs within, or extensively within the Project Area, the implementation of pre-construction surveys in suitable habitats that would be disturbed by each of the alternatives, and the implementation of avoidance measures if new occurrences are discovered.

Additional Recommendations or Mitigation Measures

Pre-construction surveys for giant helleborine will occur between June 1 and July 31 when the species is most likely to be flowering.

3.2.3 Pagosa Skyrocket

Species Information

Status

The Pagosa skyrocket is classified as a sensitive species by Region 2 of the FS and the BLM in the State of Colorado.

Distribution

This species is endemic to the Pagosa Springs area, 10 miles east of the Project Area. There are no known occurrences of this species in the Project Area, although suitable habitats are known to occur. Undocumented occurrences of this species may exist in the Project Area based on the presence of substantial areas of potential habitat that may not have been surveyed and the proximity of known occurrences to the Project Area. Within the Project Area, 38,725 acres of pinyon-juniper, Gambel oak, ponderosa pine, and barren community types on NFS lands may be suitable for this species (Table 4).

Life History

The Pagosa skyrocket flowers between late May and early August (Spackman et. al. 1997). It is found at elevations between 6,800 and 7,200 feet on fine-textured soils derived from the Mancos formation. Habitats include barren shales, pinyon-juniper, ponderosa pine, or scrub oak communities.

Factors of Concern

Construction within occupied habitat would be of concern to this species, based on the potential for degradation or loss of habitat and the destruction of individuals or entire occurrences of this species.

Environmental Baseline

No CBM-related impacts to known occurrences have been documented. There is the potential for undocumented occurrences to have been affected by existing CBM development; however there is no documentation that this impact has occurred.

Effects of the Alternatives

Alternatives 1, 1A, 1B, 2, and 3 propose the same number and type of wells and facilities near known occurrences of this species. Alternatives 4 and 5 involve construction of fewer wells and facilities near known occurrences. The types of effects to this species are the same among the alternatives and vary only according to the amount of habitat disturbed by each alternative. In general, alternatives that involve more wells and facilities (for example, Alternative 2) are more likely to affect this species and its habitats than are alternatives with fewer wells and facilities (for example, Alternative 5). Table 5 summarizes the amount of disturbance to suitable habitats for the Pagosa skyrocket for each alternative. Alternative 2 would disturb 2 percent (941 acres) of the suitable habitats on NFS lands in the Project Area, the most by any alternative. Alternative 1 would disturb 1 percent of habitat for the Pagosa skyrocket on NFS lands, and Alternatives 1A, 1B, 3, 4, and 5 would disturb less than 1 percent of the habitats on NFS lands (Table 5).

Potential effects to the Pagosa skyrocket include injury or death to individuals as a result of trampling or crushing by machinery, disturbance or destruction of habitats, and introduction of non-native species. These same activities may also result in disturbance or destruction of habitats by altering surface soil conditions, altering the local hydrologic regime, and creating erodible conditions. Disturbance to habitats may also create conditions that are conducive to establishment of non-native plant species. Many non-native plant species can out-compete native species for habitat resources, which could lead to reduction in numbers and possible local extinction of this species.

Within the cumulative effects analysis area, 260,513 acres pinyon-juniper, Gambel oak, ponderosa pine, and barren habitats are suitable for the Pagosa skyrocket. Depending on alternative, between 10,718 and 11,774 acres of these habitats would be cumulatively affected by past oil and gas development, the alternatives to the proposed project, and the alternative selected for the SUIT EIS. The cumulative disturbance to these habitats accounts for 4.1 to 4.5 percent of potential habitat in the cumulative effects analysis area for this species. Although it is unlikely that most of these habitats support the Pagosa skyrocket, this analysis indicates the extent of potential cumulative effects to this species habitat. Activities on private lands, such as sand and gravel mining, livestock grazing, agriculture, road construction, and rural and urban housing development, may occur in habitats that support the Pagosa skyrocket. The extent of these impacts, and the potential for them to affect this species, are not quantifiable.

Mitigation measures designed to avoid effects to Pagosa skyrocket from all project activities would be implemented on federal jurisdiction and would minimize the potential for any cumulative effects to this

species. Specific mitigation measures are described in the EIS that apply to sensitive species and are listed in Section 2.3.2, Project Design Recommendations, of this BE. The following specific mitigation measures apply to the Pagosa skyrocket:

- Minimize the number and length of new access roads.
- Minimize disturbance by clearing and otherwise disturbing only vegetation within the minimum area needed for safe and efficient development, production, and maintenance. Extra efforts should be used to avoid disturbance of stands of old-growth ponderosa pine.
- Conduct preconstruction surveys for Pagosa skyrocket in all potential disturbance areas that are identified as suitable habitat during the pre-construction phase of the project.
- Avoid individuals and populations of Pagosa skyrocket that may be affected by activities.

Determination

Implementation of any of the alternatives, as described above, would have **no impact** on the Pagosa skyrocket on federal jurisdiction. This determination is based on implementation of pre-construction surveys in suitable habitats on federal lands that would be disturbed by each of the alternatives and implementation of avoidance measures if new occurrences are discovered.

Additional Recommendations or Mitigation Measures

Pre-construction surveys for Pagosa skyrocket will occur between May 15 and June 15 when the species is most likely to be flowering.

3.2.4 Pagosa Springs Bladderpod

Species Information

Status

The Pagosa Springs bladderpod is classified as a sensitive species by Region 2 of the FS and the BLM in the State of Colorado.

Distribution

This species is endemic to Archuleta County, Colorado, in the Pagosa Springs area, east of the Project Area. There are no known occurrences of this species in the Project Area, although suitable habitats for this species are known to occur. This species may occur in the Project Area because suitable habitats have been identified (Ladyman 2002) and the proximity of known occurrences to the Project Area. Within the Project Area, 22,998 acres of grassland, pinyon-juniper, Gambel oak, ponderosa pine, mixed conifer, and barren community types on NFS lands may be suitable for this species (Table 4).

Life History

The Pagosa Springs bladderpod flowers from May to August and sets spherical, inflated fruits from June to August. It occurs at elevations between 6,800 to 8,300 feet on fine-textured soils derived from Mancos Formation shale. Potential habitats include barren areas surrounded by montane grasslands and open stands of ponderosa pine with scrub oak, Douglas-fir, or Engelmann spruce communities (Spackman et al. 1997).

Factors of Concern

Pagosa Springs has become increasingly popular as a resort in recent years. Recreational development and increased use of off-road vehicles are contributing factors in diminishing habitats for this species (Colorado Native Plant Society [CNPS] 1989). Activities that would create a surface disturbance in occupied habitat would be of concern to this species based on the potential for degradation or loss of habitat and the destruction of individuals or entire occurrences.

Environmental Baseline

No CBM-related impacts to known occurrences have been documented. There is the potential for undocumented occurrences to have been affected by CBM development; however, there is no documentation of that effect

Effects of the Alternatives

Alternatives 1, 1A, 1B, 2, and 3 propose the same number and type of wells and facilities near known occurrences of this species. Alternatives 4 and 5 involve construction of fewer wells and facilities near known occurrences. The potential effects to this species are the same among the alternatives and vary only according to the amount of disturbed habitats estimated for each alternative. Table 5 summarizes the amount of disturbance by alternative to habitats for the Pagosa Springs bladderpod. Alternative 2 would disturb 4 percent (806 acres) of the habitats, the most by any alternative. Alternative 1 would disturb 2 percent (436 acres) and Alternative 1A would disturb 1 percent. Alternatives 1B, 3, 4, and 5 would each disturb less than 1 percent of the habitats on NFS lands in the Project Area.

Potential effects to the Pagosa Springs bladderpod include injury or death to individuals, disturbance or destruction of habitats, and introduction of competitive non-native species. Human and construction activity within occupied habitats may cause injury to or mortality of individuals. The likelihood of this effect is low and would occur only if project activities occurred in habitats that support undocumented populations of this species. These same activities may also cause disturbance or destruction of suitable habitats by altering surface soil conditions, damaging vegetation, altering the local hydrologic regime, and creating erodible conditions. Degradation or loss of suitable habitats may diminish the survivorship of local populations by limiting the opportunity for population expansion. Disturbance to suitable habitats may also create conditions that are susceptible to establishment of non-native plant species. Many non-native plant species can out-compete native species for habitat resources, which can lead to reduction in numbers and possible local extinction of native species.

Preconstruction surveys would be conducted on federal lands in suitable habitats that may be disturbed. The area of occurrence would be avoided if these surveys identify the presence of this species. These avoidance measures would minimize the potential for affecting this species on federal lands.

Within the cumulative effects analysis area, 300,871 acres of grassland, pinyon-juniper, Gambel oak, ponderosa pine, mixed conifer, and barren habitats are suitable for the Pagosa Springs bladderpod. Depending on alternative, between 15,050 and 15,750 acres of these habitats would be cumulatively disturbed by past oil and gas development, the alternatives to the proposed project, and the alternative selected for the SUIT EIS. The cumulative disturbance to these habitats accounts for 5 to 5.2 percent of the available potential habitat in the cumulative effects analysis area for this species. This analysis indicates the extent of potential cumulative effects to this species and its habitat. Activities on private lands, such as sand and gravel mining, livestock grazing, agriculture, road construction, and rural and urban housing development may occur in habitats that support the Pagosa Springs bladderpod. The extent of these impacts, and the potential for them to affect this species, are not quantifiable.

Mitigation measures on federal land designed to avoid effects to Pagosa Springs bladderpod from all project activities would be implemented and would minimize the potential for any cumulative effects to this species. Specific mitigation measures are mentioned in the EIS that apply to sensitive species and are listed in Section 2.3.2, Project Design Recommendations, of this BE. The following specific mitigation measures apply to the Pagosa Springs bladderpod:

- Minimize the number and length of new access roads.
- Construct access roads to new wells as spurs from the existing road system rather than as separate primary access roads where possible.
- Conduct periodic employee and contractor wildlife awareness programs that cover seasonal wildlife requirements and sensitivities, how disturbances affect wildlife, and ways personnel can reduce disturbances.
- Implement a travel management plan on NFS lands that shifts roads currently designated as open to motorized use to a closed designation to help reduce adverse indirect impacts from disturbance.
- Implement effective road closures (to public, motorized uses) to the extent possible on newly developed road systems.
- Minimize disturbance by clearing and otherwise disturbing only vegetation within the minimum area needed for safe and efficient development, production, and maintenance. Extra efforts should be used to avoid disturbance of stands of old-growth ponderosa pine.
- Locate well pads, compressors, and other non-linear facilities outside of riparian areas, wetlands, and floodplains to protect the biological and hydrologic features.
- Conduct preconstruction surveys for Pagosa Springs bladderpod in all potential areas of disturbance that are identified as suitable habitat during the pre-construction phase of the project. Avoid individuals and populations of Pagosa Springs bladderpod that may be affected by activities.

Determination

Implementation of any of the alternatives, as described above, would have **no impact** on the Pagosa Springs bladderpod on federal jurisdiction. This determination is based on the low likelihood that this species occurs within the Project Area, the implementation of pre-construction surveys in suitable habitats that would be disturbed by each of the alternatives, and the implementation of avoidance measures if new occurrences are discovered

Additional Recommendations or Mitigation Measures

A complete list of recommendations and mitigation measures is provided in the EIS and in section 2.3.2 of this BE. No other measures are suggested for this species.

3.2.5 Dwarf Shrew

Species Information

Status

The dwarf shrew is classified as a sensitive species by Region 2 of the FS.

Distribution

The dwarf shrew is confined to the Rocky Mountain region from Montana to southern New Mexico. In the southern mountains of Colorado, the species is known to inhabit elevations above 5,500 feet. Collections have been made along the Arkansas River, in Mesa Verde National Park, and near Durango. This species may occur in the Project Area, although no data on population size or trends are available. On NFS lands in the Project Area, 46,078 acres of sagebrush, pinyon-juniper, mountain shrub, Gambel oak, ponderosa pine, mixed conifer, aspen, and riparian/wetland community types may be suitable for this species (Table 4).

Life History

Very little is known about the ecology, behavior, or reproductive cycles of this species in Colorado (Fitzgerald et al. 1994). The dwarf shrew has been collected in a variety of habitat types: from the edges of alpine and subalpine rockslides; spruce-fir bogs; coniferous forests; sedge marsh; dry, brushy hillsides; and open woodland (Fitzgerald et al. 1994). Apparently, the shrew can tolerate arid conditions, as some captures were as far as 0.5 mile from water.

Although little is specifically known about the dwarf shrew, some common life history traits are shared by the shrew family. They typically live in shallow tunnels or create runways in the litter of the surface of the soil (Fitzgerald et al. 1994). They may use the tunnels of other moles or voles. Shrews seldom live more than 1 year. Their high metabolic rate requires that they feed almost constantly, and they will eat practically any animal matter available. Their food may include other small mammals, but generally consists of insects and other small invertebrates.

Factors of Concern

In light of the absence of information specifically for this species, factors of concern as they relate to management activities are not well understood. Activities that would compact surface soil and ground litter could affect tunnel structures. Similarly, activities that would affect the amount and distribution of litter and coarse woody debris could affect the availability of suitable hiding cover. In general, any management activity that reduces the complexity and diversity of vegetation and woody debris in an area will reduce the diversity of insects, the primary food source for the dwarf shrew.

Environmental Baseline

No CBM-related impacts to this species have been documented.

Impacts to the species may include loss of habitat caused by road building, residential development, agricultural clearing of land, and degradation of habitat caused by these same factors, as well as ORV use and livestock grazing.

Effects of the Alternatives

Alternatives 1, 1A, 1B, 2, and 3 propose the same number and type of wells and facilities near known occurrences of this species. Alternatives 4 and 5 involve construction of fewer wells and facilities near known occurrences. The types of effects to this species are the same among the alternatives and vary only according to the amount of habitat disturbed by each alternative. In general, alternatives that involve more wells and facilities (for example, Alternative 2) are more likely to affect this species and its habitats than are alternatives with fewer wells and facilities (for example, Alternative 5). Table 5 summarizes the amount of disturbance to suitable habitats for the dwarf shrew by alternative. Alternative 2 would disturb 2 percent (1,075 acres) of the habitats in the Project Area, the most by any alternative. Alternative 1

would disturb about 2 percent (672 acres) and Alternatives 1A, 1B, 3, 4, and 5 would each disturb less than 1 percent of the habitats on NFS lands (Table 5).

Potential impacts to the dwarf shrew may include injury or death to individuals and degradation or loss of habitats. Human and construction activities within occupied habitats may trample or crush individuals, causing injury or mortality. Construction may disturb or destroy habitats. Construction, including use of heavy machinery, may cause localized compaction of soils and ground litter and subsequently limit the tunneling ability of the shrew. Disturbance may also reduce the ability of habitats to support invertebrates, the shrew's main prey species.

Within the cumulative effects analysis area, 377,319 acres of sagebrush, pinyon-juniper, mountain shrub, Gambel oak, ponderosa pine, mixed conifer, aspen, and riparian/wetland habitats are suitable for the dwarf shrew. Depending on alternative, between 17,416 and 18,653 acres of these habitats would be cumulatively disturbed by past oil and gas development, the alternatives to the proposed project, and the alternative selected for the SUIT EIS. The cumulative disturbance to these habitats accounts for 4.6 to 4.9 percent of the available potential habitat in the cumulative effects analysis area for this species. Although it is unlikely that most of these habitats support the dwarf shrew, this analysis indicates the extent of potential cumulative habitat loss to this species. Activities on private lands, such as sand and gravel mining, livestock grazing, agriculture, road construction, and rural and urban housing development, would occur in habitats that may support the dwarf shrew. The extent of these impacts, and the potential for them to affect this species, are not quantifiable.

Other cumulative effects to the dwarf shrew, such as reduced habitat effectiveness, vehicle collision, individual mortality, and habitat fragmentation, would occur but are not quantifiable. The principal cause of these effects on public and tribal lands is primarily oil and gas development and road use; on private lands, residential development is a major factor of concern. Mitigation measures designed to avoid effects to the dwarf shrew from all project activities would be implemented and would minimize the potential for any adverse cumulative impacts to this species. Specific mitigation measures are described in the EIS that apply to sensitive species and are listed in Section 2.3.2, Project Design Recommendations, of this BE. The following specific mitigation measures apply to the dwarf shrew:

- Minimize the number and length of new access roads.
- Construct access roads to new wells as spurs from the existing road system rather than as separate primary access roads where possible.
- Prohibit employees and contractors from bringing dogs or carrying firearms on site.
- Conduct periodic employee and contractor wildlife awareness programs that cover seasonal wildlife requirements and sensitivities, how disturbances affect wildlife, and ways personnel can reduce disturbances.
- Implement a travel management plan on NFS lands that shifts roads currently designated as open to motorized use to a closed designation to help reduce adverse indirect impacts from disturbance.
- Implement effective road closures (to public, motorized uses) to the extent possible on newly developed road systems.
- Remove all contaminants from project sites to avoid exposure to wildlife.
- Fence or cover emergency pits that are connected to each disposal well to prevent animals from drinking any contaminated water.

- Minimize disturbance by clearing and otherwise disturbing only vegetation within the minimum area needed for safe and efficient development, production, and maintenance. Extra efforts should be used to avoid disturbance of stands of old-growth ponderosa pine.
- Protect and retain snags and down-dead logs to the extent possible. All snags and logs may be removed from areas of active construction and ground disturbance. Snags and logs outside of disturbance areas should be removed only when they pose a hazard to human life and property.
- Locate well pads, compressors, and other non-linear facilities outside of riparian areas, wetlands, and floodplains to protect the biological and hydrologic features.

Determination

Implementation of any of the alternatives, as described above, **may adversely impact individuals, but is not likely to result in a loss of viability on the planning area, nor cause a trend towards federal listing or a loss of species viability range wide** for the dwarf shrew. This determination is based on the potential for injury or mortality to individuals and the low likelihood that these impacts would alter population health or warrant a change in protective status for this species because of the many conservation measures intended to minimize impacts to shrew individuals and shrew habitat. Additionally, less than 5 percent of the total potential habitat within the cumulative effects analysis area will be impacted.

Additional Recommendations or Mitigation Measures

A complete list of recommendations and mitigation measures is provided in the EIS. No other measures are suggested for this species.

3.2.6 Spotted Bat

Species Information

Status

This species is classified as sensitive by Region 2 of the FS and the BLM in the State of Colorado and is of special concern because of its rarity throughout its range.

Distribution

The spotted bat ranges from southern British Columbia to Mexico. In the United States, it is known from all of the states (except Washington) west of and including Montana, Wyoming, Colorado, New Mexico, and Texas. Although its distribution is broad, it is extremely patchy and closely associated with prominent rock features. It has been found from extremely arid low desert habitats to high elevation forests. There is a single record of this species in southwestern Colorado, in Montezuma County (Fitzgerald et al. 1994). A survey conducted by Black and Wood (2003) on 24 proposed CBM well sites within NSF lands concluded that suitable bat habitat was very limited and no caves were observed.

This species may occur in suitable habitats in the Project Area. Within the Project Area, 24,819 acres of grassland, sagebrush, pinyon-juniper, mountain shrub, Gambel oak, ponderosa pine, mixed conifer, aspen, riparian/wetland, and barren community types on NFS lands may be suitable for the spotted bat (Table 4).

Life History

The ecology of this species is poorly understood. The spotted bat has been captured in ponderosa pine forests, pinyon-juniper woodlands, and open desert shrublands. Rocky cliffs are necessary to provide suit-

able cracks and crevices for roosting. Specific characteristics of the roost are not known, however (Western Bat Working Group [WBWG] 1998).

Foraging has been observed in forest openings, pinyon-juniper woodlands, large riverine/riparian habitats, riparian habitat associated with small to mid-sized streams in narrow canyons, wetlands, meadows, and agricultural fields (WBWG 1998). This species forages alone in open habitat, flying 5 to 10 meters above the ground. Foraging usually occurs after midnight. Its diet appears to consist of moths, but grasshoppers, beetles, katydids, and perhaps smaller insects may be taken (Fitzgerald et al. 1994).

Spotted bats emit a low-frequency, generally audible, echolocation call. Leonard and Fenton (1984) hypothesized that the calls may help individuals space themselves in suitable habitat. Little is known about this species' reproductive ecology, although lactating females have been captured from June until mid-August in various parts of their range.

Factors of Concern

Historically, the spotted bat has endured little impact from human disturbance because its roosts are remote, but creation and subsequent flooding of reservoirs may eliminate suitable roosting habitat. Recreational rock climbing also may disturb bats in local situations. Large-scale pesticide programs to control Mormon crickets and grasshoppers could affect this species by reducing the availability of prey. Loss of foraging habitats because of activities such as livestock grazing may also affect this bat (Fitzgerald et al. 1994).

Environmental Baseline

No CBM-related impacts to this species have been documented. Impacts to the species may include disturbance to foraging and roosting bats caused by human presence, natural resource development, and agricultural and range management practices.

Effects of the Alternatives

Alternatives 1, 1A, 1B, 2, and 3 propose the same number and type of wells and facilities near known occurrences of this species. Alternatives 4 and 5 involve construction of fewer wells and facilities near known occurrences. The types of effects to this species are the same among the alternatives and vary only according to the amount of habitat disturbed by each alternative. In general, alternatives that involve more wells and facilities (for example, Alternative 2) are more likely to affect this species and its habitats than are alternatives with fewer wells and facilities (for example, Alternative 5). Table 5 summarizes the amount of disturbance by alternative to habitats for the spotted bat. Alternative 2 would disturb 3 percent (858 acres) of the potential suitable habitat types in the Project Area, the most by any alternative. Alternative 1 would disturb 2 percent (411 acres) and Alternatives 1A and 4 would each disturb 1 percent. Alternatives 1B, 3, and 5 would each disturb less than 1 percent of the habitat on NFS lands (Table 5).

Implementation of any of the alternatives may degrade spotted bat habitats. This species forages in a variety of habitats, all of which are likely to experience some degree of disturbance from implementation of the project. Although the carrying capacity of undisturbed foraging habitats and their suitability to support displaced bats are unknown, bats are expected to use these habitats without impacts to individual health or population status. Furthermore, implementation of the project is not expected to cause injury or mortality to individual spotted bats because they feed outside the typical working hours and their roosting habitats, in the crevices of rocks, are not likely to be disturbed. In addition, no large cliff complexes of the type thought to support roosting spotted bats are found on NFS lands in the Project Area. Implementation of the project is not expected to affect the occurrence or availability of invertebrate prey species.

Within the cumulative effects analysis area, 414,395 acres of grassland, sagebrush, pinyon-juniper, mountain shrub, Gambel oak, ponderosa pine, mixed conifer, aspen, riparian/wetland, and barren habitats are suitable for the spotted bat. Depending on alternative, between 21,827 and 22,618 acres of these habitats would be cumulatively disturbed by past oil and gas development, the alternatives, and the alternative selected for the SUIT EIS. The cumulative disturbance to these habitats accounts for 5.3 to 5.5 percent of the available habitats in the cumulative effects analysis area for this species. The spotted bat uses relatively small-scale, unique habitat features as roost sites within the more general habitat categories where acreage estimates are available. These estimates of general cumulative habitat loss represent an attempt to quantify impacts to foraging habitats for the spotted bat in the cumulative effects analysis area. Although it is unlikely that most of these habitats support the spotted bat, this analysis indicates the extent of potential cumulative effects to this species. Impacts to roost sites for the spotted bat are unlikely because few activities take place on the rocky cliffs typically used for roosting. Activities on private lands, such as sand and gravel mining, livestock grazing, agriculture, road construction, and rural and urban housing development, would occur in habitats that may support the spotted bat. The extent of these impacts, and the potential for them to affect this species, are not quantifiable.

Other cumulative effects to the spotted bat, such as reduced habitat effectiveness, vehicle collision, individual mortality, and habitat fragmentation, would occur but are not quantifiable. The level of these effects on public and tribal lands is primarily related to oil and gas development and road use; on private lands, residential development is a major factor. Mitigation measures designed to avoid effects to the spotted bat from all project activities would be implemented and would minimize the potential for any cumulative effects to this species. Specific mitigation measures are described in the EIS that apply to sensitive species and are listed in Section 2.3.2, Project Design Recommendations, of this BE. The following specific mitigation measures apply to the spotted bat:

- Minimize the number and length of new access roads.
- Construct access roads to new wells as spurs from the existing road system rather than as separate primary access roads where possible.
- Prohibit employees and contractors from bringing dogs or carrying firearms on site.
- Conduct periodic employee and contractor wildlife awareness programs that cover seasonal wildlife requirements and sensitivities, how disturbances affect wildlife, and ways personnel can reduce disturbances.
- Implement a travel management plan on NFS lands that shifts roads currently designated as open to motorized use to a closed designation to help reduce adverse indirect impacts from disturbance.
- Implement effective road closures (to public, motorized uses) to the extent possible on newly developed road systems.
- Remove all contaminants from project sites to avoid exposure to wildlife.
- Fence or cover emergency pits that are connected to each disposal well to prevent animals from drinking any contaminated water.
- Install mufflers or screens on exhaust systems to the extent possible to avoid wildlife entrapment and mortality.

Determination

Implementation of any of the alternatives, as described above, **may adversely impact individuals, but is not likely to result in a loss of viability on the planning area, nor cause a trend towards federal listing or a loss of species viability range wide** for the spotted bat. This determination is based on the po-

tential for injury or mortality to individuals and the low likelihood that these impacts would alter population health or warrant a change in protective status for this species because of the many conservation measures intended to minimize impacts to bat individuals and bat feeding and roosting habitat. Additionally, less than 6 percent of the total potential habitat within the cumulative effects analysis area will be impacted.

Additional Recommendations or Mitigation Measures

If potentially suitable roosting habitats were identified in locations where they would be altered during implementation of the project, pre-construction surveys would be conducted to determine roost occupancy. Additional mitigation measures would be developed based on the results of these surveys and may include avoidance of the area during certain periods, or throughout the entire year.

3.2.7 Townsend's Big-eared Bat

Species Information

Status

The Townsend's big-eared bat is classified as a sensitive species by Region 2 of the FS and the BLM in the State of Colorado. This species is of special concern because of its sensitivity to disturbance at roosts.

Distribution

The Townsend's big-eared bat occurs throughout the west and is distributed from southern British Columbia south along the Pacific coast to central Mexico and east into the Great Plains, with isolated populations in the southern and southeastern United States.

One of the largest winter roost sites in Colorado was found in the early 1990s at a patented mine on the Mancos-Dolores District of the SJNF, west of the Project Area. CDOW biologists currently monitor the site. Elsewhere, CDOW volunteers conducted exit counts and trapped bats at various abandoned mines in La Plata Canyon during the early 1990s. No Townsend's big-eared bats were recorded in these surveys, nor have there been any other confirmed reports of this species elsewhere on the SJNF. Additionally, a survey conducted by Black and Wood (2003) on 24 proposed CBM well sites within NSF lands concluded that suitable bat habitat was very limited and no caves were observed.

Within the Project Area, 24,819 acres of grassland, sagebrush, pinyon-juniper, mountain shrub, Gambel oak, ponderosa pine, mixed conifer, aspen, riparian/wetland, and barren community types on NFS lands may be described as suitable for the Townsend's big-eared bat.

Life History

Plant communities inhabited by the Townsend's big-eared bat are diverse and include coniferous forest and woodland, deciduous riparian woodland, and semi-desert and montane shrublands. Physical habitat, especially the presence of caves or mines suitable for day and night roosting and for hibernation, is probably more important than the vegetative characteristics (Armstrong et al. 1994). Roosting habitats consist most frequently of caves and abandoned mines, but also include buildings, bridges, rock crevices, and hollow trees.

The bat breeds in late fall and winters in colonies ranging in size from a single individual to several hundred. Females assemble into nursery colonies of a few to several hundred individuals, forming dense clusters to take advantage of shared metabolic heat. Warm nursery sites are essential for reproductive success

(Humphrey and Kunz 1976). At summer roosts, individuals do not hide in cracks or crevices, but rather hang exposed from the roof or walls of the chamber, taking flight if disturbed.

During hibernation, this species is sensitive to fluctuations in temperature and humidity and moves in response to them. The availability of hibernacula with the appropriate stable temperature and humidity appears to be a limiting factor for this bat. Furthermore, they are easily disturbed and will leave caves or mines where human harassment occurs.

This species is a moth specialist, with more than 90 percent of its diet composed of moths (WBWG 1998). Caddis flies also appear to be a staple of their diet (Freeman 1984). This species often forages over water, along the margins of vegetation, and over sagebrush (Fitzgerald et al. 1994).

Factors of Concern

The primary threat is disturbance or destruction of roost sites caused by recreational caving, mine reclamation, and renewed mining in historical districts. This species is sensitive to disturbance and has been documented to abandon roost sites after human visitation. Both roosting and foraging habitats may be affected by timber harvest practices. In addition, pesticide spraying in forested and agricultural areas may affect the prey base (WBWG 1998).

Environmental Baseline

No CBM-related impacts to this species have been documented. It is possible that some occurrences of this species have been affected in the past by human disturbance in caves and other roosting habitats within the Project Area.

Effects of the Alternatives

Alternatives 1, 1A, 1B, 2, and 3 propose the same number and type of wells and facilities near known occurrences of this species. Alternatives 4 and 5 involve construction of fewer wells and facilities near known occurrences. The types of effects to this species are the same among the alternatives and vary only according to the amount of habitat disturbed by each alternative. In general, alternatives that involve more wells and facilities (for example, Alternative 2) are more likely to affect this species and its habitats than are alternatives with fewer wells and facilities (for example, Alternative 5). Table 5 summarizes the amount of disturbance by alternative to habitats for the Townsend's big-eared bat. Alternative 2 would disturb 3 percent (858 acres) of the potential suitable habitat types in the Project Area, the most by any alternative. Alternative 1 would disturb 2 percent (411 acres) and Alternatives 1A and 4 would each disturb 1 percent. Alternatives 1B, 3, and 5 would each disturb less than 1 percent of the habitat on NFS lands (Table 5).

Potential impacts to the Townsend's big-eared bat from implementation of any of the alternatives include injury to or mortality of individuals, disturbance or displacement of individuals from roosts, and degradation or destruction of suitable foraging habitats. Injury to or mortality of the Townsend's big-eared bat may be caused by construction within occupied roosting and foraging habitats. Although the potential for injury or mortality exists, it is expected to be low because project activities are not expected to occur within known roosting habitats associated with the patented mine (Mancos-Dolores District) or during nighttime foraging periods.

Construction and increased human presence within the Project Area may limit use of suitable roosting sites, including unidentified caves, rock crevices, and hollow trees. Disturbance is not expected to occur to roosting habitats in caves and rock outcrops; however, hollow trees may be disturbed or destroyed. This species forages in a variety of habitats, and all are likely to experience some degree of disturbance.

Although the carrying capacity of undisturbed foraging habitats and their suitability to support displaced bats are unknown, bats are expected to use these habitats without impacts to individual health or population status. Project activities are not expected to affect the local occurrence or availability of this bat's preferred invertebrate prey species.

Within the cumulative effects analysis area, 414,395 acres of grassland, sagebrush, pinyon-juniper, mountain shrub, Gambel oak, ponderosa pine, mixed conifer, aspen, riparian/wetland, and barren habitats are suitable for the Townsend's big-eared bat. Depending on alternative, between 21,827 and 22,618 acres of these habitats would be cumulatively disturbed by past oil and gas development, the alternatives, and the alternative selected for the SUIT EIS. The cumulative disturbance to these habitats accounts for 5.3 to 5.5 percent of the available habitats in the cumulative effects analysis area for this species. The Townsend's big-eared bat uses relatively small-scale, unique habitat features as roost sites within the more general habitat categories where acreage estimates are available. These general estimates of cumulative habitat loss represent an attempt to quantify impacts to foraging habitats for the Townsend's big-eared in the cumulative effects analysis area. Although it is unlikely that most of these habitats support the Townsend's big-eared bat, this analysis indicates the relative extent of potential cumulative effects to this species. Activities on private lands, such as sand and gravel mining, livestock grazing, agriculture, road construction, and rural and urban housing development, would occur in habitats that may support the Townsend's big-eared bat. The extent of these impacts, and the potential for them to affect this species, are not quantifiable.

Other cumulative effects to the Townsend's big-eared bat, such as reduced habitat effectiveness, vehicle collision, individual mortality, and habitat fragmentation, may occur but are not quantifiable. The level of these effects on public and tribal lands is primarily related to oil and gas development and road use; on private lands, residential development is a major factor. Mitigation measures designed to avoid effects to the Townsend's big-eared bat from all project activities would be implemented and would minimize the potential for any cumulative effects to this species. Specific mitigation measures are described in the EIS that apply to sensitive species and are listed in Section 2.3.2, Project Design Recommendations, of this BE. The following specific mitigation measures apply to the Townsend's big-eared bat:

- Minimize the number and length of new access roads.
- Construct access roads to new wells as spurs from the existing road system rather than as separate primary access roads where possible.
- Prohibit employees and contractors from bringing dogs or carrying firearms on site.
- Conduct periodic employee and contractor wildlife awareness programs that cover seasonal wildlife requirements and sensitivities, how disturbances affect wildlife, and ways personnel can reduce disturbances.
- Implement a travel management plan on NFS lands that shifts roads currently designated as open to motorized use to a closed designation to help reduce adverse indirect impacts from disturbance.
- Implement effective road closures (to public, motorized uses) to the extent possible on newly developed road systems.
- Remove all contaminants from project sites to avoid exposure to wildlife.
- Fence or cover emergency pits that are connected to each disposal well to prevent animals from drinking any contaminated water.
- Install mufflers or screens on exhaust systems to the extent possible to avoid wildlife entrapment and mortality.

Determination

Implementation of any of the alternatives, as described above, **may adversely impact individuals, but is not likely to result in a loss of viability on the planning area, nor cause a trend towards federal listing or a loss of species viability range wide** for the Townsend's big-eared bat. This determination is based on the low likelihood that this species occurs within the Project Area, the potential for suitable, undisturbed habitats to support displaced individuals, and the low likelihood that these impacts would alter population health or warrant a change in protective status for this species because of the many conservation measures intended to minimize impacts to bat individuals and bat feeding and roosting habitat. Additionally, less than 6 percent of the total potential habitat within the cumulative effects analysis area will be impacted.

Additional Recommendations or Mitigation Measures

If potentially suitable roosting habitat were identified during implementation of the project, preconstruction surveys would be conducted to evaluate roost occupancy. Additional mitigation measures would be developed based on the results of these surveys and may include avoidance of the area during part or all of the year.

3.2.8 Ringtail

Species Information

Status

The ringtail is classified as a sensitive species by Region 2 of the FS.

Distribution

The ringtail is found across the southern half of the western United States as far east as Louisiana and south to Mexico (Fitzgerald et al. 1994). In Colorado, ringtails are more widely distributed than was previously recognized and have been found in rough country at moderate elevations up to and above 9,000 feet on either side of the Continental Divide (Gavin and Richards 1993). They are absent in the northeastern part of the state. In southern Colorado, they have been documented in Alamosa, Costilla, Conejos, Rio Grande, Saguache, Mineral, Archuleta, La Plata, Montezuma, Dolores, and San Miguel Counties (Fitzgerald et al. 1994). They are probably most common in the canyon country in the southwestern part of the state. No structured inventories have been conducted for the ringtail on the SJNF, but it is expected to occur in suitable habitats throughout the Project Area. Within the Project Area, 39,188 acres of pinyon-juniper, mountain shrub, Gambel oak, ponderosa pine, riparian/wetland, and barren community types on NFS lands may be suitable for the ringtail (Table 4).

Life History

Colorado ringtails are associated with rocky canyon country and foothills areas of pinyon-juniper woodlands, montane shrublands, or mixed conifer-oak brush (Fitzgerald et al. 1994). They also use dense riparian growth, including cottonwood riparian areas (Towry 1984). Their habitat needs are not well understood, but open water and denning cavities are critical features. They are seldom found more than 0.5 mile from water (Kaufmann 1982). Rock crevices and tree cavities are the preferred denning and rest sites, but they also use caves, burrows dug by other animals, brush piles, and occupied and unoccupied buildings.

This species feeds on a wide variety of animal and plant materials, but consumes a higher proportion of animal matter than do raccoons (Kaufmann 1982). Their carnivorous diet includes small mammals, birds, bird eggs, reptiles, amphibians, and insects. Wood rats and brush-nesting birds are mainstays of the diet.

Their plant diet includes berries and fleshy fruits of shrubs and cacti. Mortality factors are not well known, but great horned owls, snakes, and domestic dogs and cats have been reported to kill ringtails (Fitzgerald et al. 1994). Some are also killed by cars and by trapping.

Factors of Concern

Any management practice that removes denning trees could reduce the suitability of habitats for ringtails. Increased human access could result in changes in distribution patterns and habitat usage.

Environmental Baseline

No CBM-related impacts to this species have been documented; however, it is likely that this species has been affected by past by human disturbance in the Project Area. Impacts to the species may include loss of habitat caused by road building, residential development, and agricultural clearing of land, and degradation of habitat because of these same factors, as well as ORV use and livestock grazing.

Effects of the Alternatives

Alternatives 1, 1A, 1B, 2, and 3 propose the same number and type of wells and facilities near known occurrences of this species. Alternatives 4 and 5 involve construction of fewer wells and facilities near known occurrences. The types of effects to this species are the same among the alternatives and vary only according to the amount of habitat disturbed by each alternative. In general, alternatives that involve more wells and facilities (for example, Alternative 2) are more likely to affect this species and its habitats than are alternatives with fewer wells and facilities (for example, Alternative 5). Table 5 summarizes the amount of disturbance by alternative to suitable ringtail habitats. Alternative 2 would disturb 2 percent (950 acres) of the habitats in the Project Area, the most by any alternative. Alternative 1 would disturb about 2 percent (675 acres) and Alternatives 1A, 1B, 3, 4, and 5 would disturb less than 1 percent of the habitat on NFS lands (Table 5).

Potential impacts to the ringtail caused by implementation of any of the alternatives include injury to or mortality of individuals, disturbance or displacement of individuals, and degradation or destruction of suitable habitats. Injury or mortality may occur to individuals that are unable to avoid construction. An increase in human activity within the Project Area also may displace individuals from otherwise suitable habitats. Denning, resting, and foraging habitats may be degraded or disturbed by project construction. Although the carrying capacity of undisturbed habitats and their suitability to support displaced individuals are unknown, ringtails are expected to use these habitats without impacts to individual health or population status.

Within the cumulative effects analysis area, 288,307 acres of pinyon-juniper, mountain shrub, Gambel oak, ponderosa pine, riparian/wetland, and barren habitats are suitable for the ringtail. Depending on alternative, between 12,339 and 13,429 acres of these habitats would be cumulatively disturbed by past oil and gas development, the alternatives to the proposed project, and the alternative selected for the SUIT EIS. The cumulative disturbance to these habitats accounts for 4.3 to 4.7 percent of the available habitats in the cumulative effects analysis area. Although it is unlikely that most of these habitats support the ringtail, this analysis indicates the extent of potential cumulative effects to this species and its habitat. Activities on private lands, such as sand and gravel mining, livestock grazing, agriculture, road construction, and rural and urban housing development, may occur in habitats that support the ringtail. The extent of these impacts, and the potential for them to affect this species, are not quantifiable.

Other cumulative effects to the ringtail, such as reduced habitat effectiveness, vehicle collision, individual mortality, and habitat fragmentation, would occur but are not quantifiable. The level of these effects on public and tribal lands is related primarily to oil and gas development and road use; on private lands, resi-

dential development is a major factor. For this reason, a similar trend is expected for these effects as was shown for habitats. Specific mitigation measures are described in the EIS that apply to sensitive species and are listed in Section 2.3.2, Project Design Recommendations, of this BE. The following specific mitigation measures apply to the ringtail:

- Minimize the number and length of new access roads.
- Construct access roads to new wells as spurs from the existing road system rather than as separate primary access roads where possible.
- Prohibit employees and contractors from bringing dogs or carrying firearms on site.
- Conduct periodic employee and contractor wildlife awareness programs that cover seasonal wildlife requirements and sensitivities, how disturbances affect wildlife, and ways personnel can reduce disturbances.
- Implement a travel management plan on NFS lands that shifts roads currently designated as open to motorized use to a closed designation to help reduce adverse indirect impacts from disturbance.
- Implement effective road closures (to public, motorized uses) to the extent possible on newly developed road systems.
- Remove all contaminants from project sites to avoid exposure to wildlife.
- Fence or cover emergency pits that are connected to each disposal well to prevent animals from drinking any contaminated water.
- Install mufflers or screens on exhaust systems to the extent possible to avoid wildlife entrapment and mortality.
- Minimize disturbance by clearing and otherwise disturbing only vegetation within the minimum area needed for safe and efficient development, production, and maintenance. Extra efforts should be used to avoid disturbance of stands of old-growth ponderosa pine.
- Protect and retain snags and down-dead logs to the extent possible. All snags and logs may be removed from areas of active construction and ground disturbance. Snags and logs outside of disturbance areas should be removed only when they pose a hazard to human life and property.
- Locate well pads, compressors, and other non-linear facilities outside of riparian areas, wetlands, and floodplains to protect the biological and hydrologic features.

Determination

Implementation of any of the alternatives, as described above, **may adversely impact individuals, but is not likely to result in a loss of viability on the planning area, nor cause a trend towards federal listing or a loss of species viability range wide** for the ringtail. This determination is based on the potential for injury or mortality to individuals and the low likelihood that these impacts would alter population health or warrant a change in protective status for this species because of the many conservation measures intended to minimize impacts to ringtail individuals and ringtail habitat.

Additional Recommendations or Mitigation Measures

A complete list of recommendations and mitigation measures is provided in the EIS. No other measures are suggested for this species.

3.2.9 Northern Goshawk

Varying amounts of northern goshawk habitat would be removed under each alternative (Table 5). Alternative 2 (the most extensive) would remove 397 acres (2 percent) of the 18,984 acres of goshawk habitats distributed through the Project Area. Direct and indirect effects on the goshawk are small for each alternative, ranging in magnitude from minor (individuals not likely affected) to moderate (individuals may be affected, but populations would not be affected). For all factors analyzed, Alternative 2 is the most extensive followed in descending order of overall impact by Alternatives 1, 1A, 1B, 3, 4, and 5 (Table 5).

Potential impacts to the northern goshawk caused by implementation of any of the alternatives include degradation and/or direct loss of habitat including foraging areas and habitat fragmentation. To a much lesser degree, injury or mortality may occur to individuals related to vehicle collisions and encounters with constructed CBM appurtenant facilities. An increase in human activity within the Project Area also may displace and shift home ranges of individuals from otherwise suitable habitats. Increased motorized recreational use of the SJNF could follow CBM development, decreasing goshawk habitat effectiveness. However, the vehicle access restrictions proposed in Alternatives 1 through 3 would close many project roads to ATV and other motorized public uses and restrict ATVs to designated travel routes on NFS land. Only authorized vehicles (mainly industry, Agency, and law enforcement) would utilize the majority of the road system.

Within the cumulative effects analysis area, 26,715 acres of woodland habitats are suitable for the northern goshawk. Given that goshawk foraging areas are about 5,400 acres (Reynolds et al. 1992), in theory there could be habitat to support territories for 5 goshawk pair across the entire Cumulative Effects Analysis Area. It is not likely that all modeled habitat would be effective for goshawk. Variation in structure, patch size, location within the landscape, Gambel oak density, opening size, etc., can all affect habitat effectiveness for the species. Additionally, Rhea Environmental Consulting (2002) conducted northern goshawk field surveys in an effort to determine active goshawk nesting territories within the project area. Results of the Rhea Environmental Consulting survey (2002) found two active goshawk-nesting territories, and at least two other probable nesting territories. The results of this survey are within the expectations of Reynolds et al. (1992) territory area findings for northern goshawks

Potential habitat loss associated with oil and gas development throughout the cumulative effects area is low even for the most extensive development alternative (Alternative 2 = 959 acre loss). Activities on private lands, such as sand and gravel mining, livestock grazing, agriculture, road construction, and rural and urban housing development, may occur in habitats that support the northern goshawk. The extent of these impacts, and the potential for them to affect this species, are not quantifiable.

Other cumulative effects to the northern goshawk, such as timber management, prescribed burns, grazing, and recreational use would continue to impact the northern goshawk. Low to moderate levels of timber harvest and prescribed burning would continue within the roaded portions of the cumulative effects area, both of which would promote more open stand characteristics that may negatively affect habitats in the short-term, but be beneficial to goshawk habitats in the long-term. Additionally, grazing practices on the SJNF would continue to promote improved range condition and improved habitat. Grazing practices on non-federal land within the cumulative effects area would continue to be varied with effects ranging from positive to negative. Less grazing land are expected in the western portion on the Project Area due to additional urban development.

There are currently sufficient habitats available to support sustaining territories, well distributed across the Project Area on NFS land. Habitats in the Project Area are distributed such that adequate dispersal and species interactions should continue under all alternatives. CBM development on NFS land would negligibly contribute to a change in the current stable overall habitat trend for the 20-year analysis period.

Consequently, activities occurring on NFS land are expected to have minor to moderate affect on individuals and negligibly affect populations of goshawk in the Project Area and throughout the SJNF.

Determination

Implementation of any of the alternatives, as described above, **may adversely impact individuals, but is not likely to result in a loss of viability on the planning area, nor cause a trend towards federal listing or a loss of species viability range wide** for the goshawk. This determination is based on implementation of pre-construction surveys in suitable habitats that would determine the presence of active goshawk nests within habitats to be disturbed, the potential for suitable, undisturbed habitats to support displaced individuals, and implementation of additional mitigation measures. Specific mitigation measures are described in the EIS that apply to sensitive species and are listed in Section 2.3.2, Project Design Recommendations, of this BE. The following specific mitigation measures apply to the northern goshawk:

- Minimize the number and length of new access roads.
- Construct access roads to new wells as spurs from the existing road system rather than as separate primary access roads where possible.
- Prohibit employees and contractors from bringing dogs or carrying firearms on site.
- Conduct periodic employee and contractor wildlife awareness programs that cover seasonal wildlife requirements and sensitivities, how disturbances affect wildlife, and ways personnel can reduce disturbances.
- Implement a travel management plan on NFS lands that shifts roads currently designated as open to motorized use to a closed designation to help reduce adverse indirect impacts from disturbance.
- Implement effective road closures (to public, motorized uses) to the extent possible on newly developed road systems.
- Remove all contaminants from project sites to avoid exposure to wildlife.
- Fence or cover emergency pits that are connected to each disposal well to prevent animals from drinking any contaminated water.
- Minimize disturbance by clearing and otherwise disturbing only vegetation within the minimum area needed for safe and efficient development, production, and maintenance. Extra efforts should be used to avoid disturbance of stands of old-growth ponderosa pine.
- Protect and retain snags and down-dead logs to the extent possible. All snags and logs may be removed from areas of active construction and ground disturbance. Snags and logs outside of disturbance areas should be removed only when they pose a hazard to human life and property.
- Locate well pads, compressors, and other non-linear facilities outside of riparian areas, wetlands, and floodplains to protect the biological and hydrologic features.

Additional Recommendations or Mitigation Measures

A complete list of recommendations and mitigation measures is provided in the EIS. No other measures are suggested for this species.

3.2.10 Merlin

Species Information

Status

The merlin is classified as a sensitive species by Region 2 of the FS.

Distribution

The merlin nests throughout Alaska, Canada, and the Northern Rocky Mountains as far south as southern Wyoming. Several old records indicate this species may have nested in the mountains of Colorado (Andrews and Righter 1992). This species winters throughout Colorado except at the highest elevations. The merlin may use habitats in the Project Area during the winter, although no data on population sizes or trends are known to exist. Within the Project Area, 39,642 acres of grassland, sagebrush, pinyon-juniper, mountain shrub, ponderosa pine, mixed conifer, aspen, riparian/wetland, and barren community types on NFS lands may be suitable for the merlin (Table 4).

Life History

This species is most often observed in grasslands, agricultural areas, riparian forests, and urban areas during the winter (Andrews and Righter 1992); although occasional observations in most other habitats suggest that these types are used as well. This species hunts primarily small birds, catching them through direct pursuit rather than by diving. It will also take insects and small rodents on occasion.

Factors of Concern

Loss or alteration of habitats that support prey species may decrease winter survival.

Environmental Baseline

No CBM-related impacts to this species have been documented. There is the potential for undocumented impacts to have occurred to this species from existing CBM development; however, no data exist to show that undocumented impacts have occurred.

No other impacts to this species have been documented; however, it is likely that this species has been affected in the past by human presence and disturbance to foraging habitats in the Project Area.

Effects of the Alternatives

Alternatives 1, 1A, 1B, 2, and 3 propose the same number and type of wells and facilities near known occurrences of this species. Alternatives 4 and 5 involve construction of fewer wells and facilities near known occurrences. The types of effects to this species are the same among the alternatives and vary only according to the amount of habitat disturbed by each alternative. In general, alternatives that involve more wells and facilities (for example, Alternative 2) are more likely to affect this species and its habitats than are alternatives with fewer wells and facilities (for example, Alternative 5). Table 5 summarizes the amount of disturbance by alternative to merlin habitats. Alternative 2 would disturb 2 percent (915 acres) of the habitats in the Project Area, the most by any alternative. Alternative 1would disturb about 2 percent (615 acres) and Alternative 1A would disturb 1 percent of the habitats in the Project Area. Alternatives 1B, 3, 4, and 5 would each disturb less than 1 percent of the habitats on NFS lands (Table 5).

Potential impacts caused by implementation of any of the alternatives include disturbance or displacement of merlin and their prey species. Human presence and construction associated with the alternatives may

disturb or displace adults from otherwise suitable foraging habitats. Suitable prey species may also be disturbed or displaced by human activity and alteration of habitats. The occurrence and availability of prey would not be detrimentally affected by project actions because of the ubiquitous nature of most prey species and because undisturbed habitats probably would be suitable for and capable of supporting displaced prey species.

Within the cumulative effects analysis area, 441,020 acres of grassland, sagebrush, pinyon-juniper, mountain shrub, ponderosa pine, mixed conifer, aspen, riparian/wetland, and barren habitats are suitable for the merlin. Depending on alternative, between 22,371 and 23,444 acres of these habitats would be cumulatively disturbed by past oil and gas development, the alternatives to the proposed project, and the alternative selected for the SUIT EIS. Cumulative disturbance to these habitats accounts for 5.2 to 5.3 percent of the available habitats in the cumulative effects analysis area for this species. Merlins in the cumulative effects area are limited to wintering individuals and migrants. These individuals are non-breeding, foraging adults that do not exhibit fidelity to a site. These general estimates of cumulative habitat loss represent an attempt to quantify impacts to foraging habitats for the merlin in the cumulative effects analysis area. Although it is unlikely that most of these habitats support the merlin, this analysis indicates the extent of potential cumulative effects to this species and its habitat. Activities on private lands, such as sand and gravel mining, livestock grazing, agriculture, road construction, and rural and urban housing development, may occur in habitats that support the merlin. The extent of these impacts, and the potential for them to affect this species, are not quantifiable.

Other cumulative effects, although difficult to quantify, could be caused by activities on private lands, such as sand and gravel mining, livestock grazing, agriculture, road construction, and rural and urban housing development. Some of these activities may occur in habitats that support the merlin. The extent of these impacts, and the potential for them to affect this species, are not quantifiable. The level of these effects on public and tribal lands is related primarily to oil and gas development and road use; on private lands, residential development is also a major factor. For this reason, a trend similar to effects on habitat is expected for these effects. Specific mitigation measures are described in the EIS that apply to sensitive species and are listed in Section 2.3.2, Project Design Recommendations, of this BE. The following specific mitigation measures apply to the merlin:

- Minimize the number and length of new access roads.
- Construct access roads to new wells as spurs from the existing road system rather than as separate primary access roads where possible.
- Prohibit employees and contractors from bringing dogs or carrying firearms on site.
- Conduct periodic employee and contractor wildlife awareness programs that cover seasonal wildlife requirements and sensitivities, how disturbances affect wildlife, and ways personnel can reduce disturbances.
- Implement a travel management plan on NFS lands that shifts roads currently designated as open to motorized use to a closed designation to help reduce adverse indirect impacts from disturbance.
- Implement effective road closures (to public, motorized uses) to the extent possible on newly developed road systems.
- Remove all contaminants from project sites to avoid exposure to wildlife.
- Fence or cover emergency pits that are connected to each disposal well to prevent animals from drinking any contaminated water.

- Minimize disturbance by clearing and otherwise disturbing only vegetation within the minimum area needed for safe and efficient development, production, and maintenance. Extra efforts should be used to avoid disturbance of stands of old-growth ponderosa pine.
- Protect and retain snags and down-dead logs to the extent possible. All snags and logs may be removed from areas of active construction and ground disturbance. Snags and logs outside of disturbance areas should be removed only when they pose a hazard to human life and property.
- Locate well pads, compressors, and other non-linear facilities outside of riparian areas, wetlands, and floodplains to protect the biological and hydrologic features.

Determination

Implementation of any of the alternatives, as described above, **may adversely impact individuals, but is not likely to result in a loss of viability on the planning area, nor cause a trend towards federal listing or a loss of species viability range wide** for the merlin. This determination is based on the assumption that the displacement of foraging individuals would be offset by the availability and suitability of other undisturbed foraging habitats and that wintering merlin exhibit little to no fidelity to foraging habitats and, therefore, have the flexibility to use other suitable, undisturbed habitats.

Additional Recommendations or Mitigation Measures

A complete list of recommendations and mitigation measures is provided in the EIS. No other measures are suggested for this species.

3.2.11 Western Burrowing Owl

Species Information

Status

The burrowing owl is classified as a sensitive species by Region 2 of the FS. This species is also listed as threatened by the State of Colorado.

Distribution

This species breeds throughout western North America and on the Great Plains. The burrowing owl winters throughout its breeding range except for the northern portions in the Great Basin and Great Plains regions (DeGraaf et al. 1991). For Colorado, Andrews and Righter (1992) considered the species a summer resident, found mostly on the eastern plains. This species is considered a non-breeder and an occasional winter visitor for the SJNF. This species has been observed breeding in Montezuma County to the west and in southern La Plata County south of the Project Area (Jones 1998). Small numbers of this species may breed at lower elevations in the western two-thirds of the Project Area, although no data are available to suggest that the owl breeds in this area. Within the Project Area, 4,678 acres of grassland, sagebrush, and barren community types on NFS lands may be suitable for the western burrowing owl (Table 4).

Life History

The burrowing owl prefers non-forested plains, grasslands, deserts, and, occasionally, open areas such as vacant lots near human habitation or airports. They largely depend on burrowing mammals, such as prairie dogs, for burrows. They also take over and modify abandoned burrows of badgers, gophers, or foxes. They typically require open areas with short vegetation for nesting, roosting, and for escape (DeGraaf et al. 1991). In some populations, breeding pairs live close together in colonies.

Burrowing owls are opportunistic feeders. Large arthropods, mainly beetles and grasshoppers, make up a large portion of their diet. Small mammals, especially mice, rats, gophers, and ground squirrels, are also important food items. Other prey animals include reptiles and amphibians, scorpions, young cottontail rabbits, bats, and birds such as sparrows and horned larks. Their nesting season begins in late March or April. The young leave the nest at about 44 days and begin chasing living insects when they are 49 to 56 days old (Haug et al. 1993).

Factors of Concern

Any activities that affect burrowing mammals would affect the availability of nesting and roosting sites for the burrowing owl. Cultivation and development, for example, have substantially reduced the owls' habitats. Disturbance near active nesting areas can disrupt breeding. Owls rely entirely on burrowing animals for their nests, and many of these animals are exterminated as pests. Burrowing owls have also been killed accidentally because of poison programs aimed at pests and insects.

Environmental Baseline

No CBM-related impacts to this species have been documented. There is the potential for undocumented impacts to have occurred to this species from existing CBM development; however, no data exist to show that undocumented impacts have occurred.

No other impacts to this species have been documented; however, it is likely that this species has been affected in the past by human presence and by disturbance to nesting and foraging habitats in the Project Area.

Effects of the Alternatives

Alternatives 1, 1A, 1B, 2, and 3 propose the same number and type of wells and facilities near known occurrences of this species. Alternatives 4 and 5 involve construction of fewer wells and facilities near known occurrences. The types of effects to this species are the same among the alternatives and vary only according to the amount of habitat disturbed by each alternative. In general, alternatives that involve more wells and facilities (for example, Alternative 2) are more likely to affect this species and its habitats than are alternatives with fewer wells and facilities (for example, Alternative 5). Table 5 summarizes the amount of disturbance by alternative to burrowing owl habitats. Alternative 2 would disturb 2 percent (98 acres) of the habitats in the Project Area, the most by any alternative. Alternative 1 would disturb about 2 percent (78 acres) and Alternatives 1A, 1B, 3, 4, and 5 would each disturb less than 1 percent of the habitats on NFS lands (Table 5).

Potential impacts to the western burrowing owl from any of the alternatives include injury to or mortality of individuals and degradation or destruction of nesting and foraging habitats. Individual owls, particularly eggs or unfledged young, may be injured or killed by heavy machinery. Adults and fledged young would not likely be harmed because of their ability to avoid human activity. Pre-construction surveys of potential nesting habitats would identify the presence of the owl and would minimize the potential for harm to adults, eggs, or young. Construction, including removal of vegetation and alteration of surface soils, may degrade or destroy nesting and foraging habitats. The availability of prey species within the Project Area would not likely be affected by implementation of the project.

Within the cumulative effects analysis area there are 178,872 acres of grassland, sagebrush, and barren habitats for the western burrowing owl. Depending on alternative, between 10,772 and 10,956 acres of these habitats would be cumulatively disturbed by past oil and gas development, the alternatives to the proposed project, and the alternative selected for the SUIT EIS. The cumulative disturbance to these habitats accounts for 6 to 6.1 percent of the available habitats in the cumulative effects analysis area. While it

is unlikely that most of these habitats support the western burrowing owl, this analysis indicates the extent of potential cumulative effects to this species and its habitats. Activities on private lands, such as sand and gravel mining, livestock grazing, agriculture, road construction, and rural and urban housing development may occur in habitats that support the western burrowing owl. The extent of these impacts, and the potential for them to affect this species, are not quantifiable.

Other cumulative effects to the western burrowing owl, such as reduced habitat effectiveness, vehicle collision, individual mortality, and habitat fragmentation, would occur but are not quantifiable. The level of these effects on public and tribal lands is primarily related to oil and gas development and road use; on private lands, residential development is also a major factor. For this reason, trends similar to habitat are expected for these effects. Mitigation measures designed to avoid effects to the western burrowing owl from all project activities would be implemented and would minimize the potential for any cumulative effects to this species. Specific mitigation measures are described in the EIS that apply to sensitive species and are listed in Section 2.3.2, Project Design Recommendations, of this BE. The following specific mitigation measures apply to the western burrowing owl:

- Minimize the number and length of new access roads.
- Construct access roads to new wells as spurs from the existing road system rather than as separate primary access roads where possible.
- Prohibit employees and contractors from bringing dogs or carrying firearms on site.
- Conduct periodic employee and contractor wildlife awareness programs that cover seasonal wildlife requirements and sensitivities, how disturbances affect wildlife, and ways personnel can reduce disturbances.
- Implement a travel management plan on NFS lands that shifts roads currently designated as open to motorized use to a closed designation to help reduce adverse indirect impacts from disturbance.
- Implement effective road closures (to public, motorized uses) to the extent possible on newly developed road systems.
- Remove all contaminants from project sites to avoid exposure to wildlife.
- Fence or cover emergency pits that are connected to each disposal well to prevent animals from drinking any contaminated water.
- Install mufflers or screens on exhaust systems to the extent possible to avoid wildlife entrapment and mortality.
- Minimize disturbance by clearing and otherwise disturbing only vegetation within the minimum area needed for safe and efficient development, production, and maintenance. Extra efforts should be used to avoid disturbance of stands of old-growth ponderosa pine.
- Protect and retain snags and down-dead logs to the extent possible. All snags and logs may be removed from areas of active construction and ground disturbance. Snags and logs outside of disturbance areas should be removed only when they pose a hazard to human life and property.
- Locate well pads, compressors, and other non-linear facilities outside of riparian areas, wetlands, and floodplains to protect the biological and hydrologic features.

Determination

Implementation of any of the alternatives, as described above, would have **no impact** on the burrowing owl. This determination is based on implementation of pre-construction surveys in suitable habitats that

would determine the presence of active burrowing owl nests within habitats to be disturbed, the low likelihood that this species occurs in the Project Area, and implementation of additional mitigation measures intended to eliminate impacts to the species.

Additional Recommendations or Mitigation Measures

A complete list of recommendations and mitigation measures is provided in the EIS. No other measures are suggested for this species.

3.2.12 Flammulated Owl

Species Information

Status

The flammulated owl is classified as a sensitive species by Region 2 of the FS. No data on population trend data are available, and the breeding bird survey (BBS) does not sample this species.

Distribution

The flammulated owl is perhaps the most common raptor of the montane pine forests of the western United States (McCallum et al. 1994). This neotropical migrant winters in Mexico and Central America and casually north to southern California (DeGraaf et al. 1991). In Colorado, the flammulated owl is an uncommon to common summer resident in foothills and lower mountains and appears to be more common than most observers have realized (Andrews and Righter 1992). It is listed as an uncommon nester in southwestern Colorado (Durango Bird Club 1992). This species appears to be more common in western and southern Colorado than in other parts of its range. There have been no structured forest-wide inventories for this species on the SJNF; however, during surveys for the Mexican spotted owl conducted between 1990 and 1994, flammulated owls were found on all districts on the SJNF within the ponderosa pine and lower mixed-conifer life zones. In addition, Black and Wood (2003) and Rhea Environmental Consulting (2002) documented up to seven and three flammulated owls, respectively during noctural raptor surveys conducted within NSF land. Therefore, this species is known to occur in suitable habitats in the Project Area, although no data on population size and trend are available. Within the Project Area, 34,501 acres of pinyon-juniper, ponderosa pine, mixed conifer, and aspen community types on NFS lands may be suitable for the flammulated owl (Table 4).

Life History

The flammulated owl is a small, obligate secondary cavity nester that is almost entirely insectivorous (McCallum et al. 1994). It is associated with mature to old-growth ponderosa pine, from the lower elevations where ponderosa pine is mixed with oak or pinyon pine to the higher elevations where ponderosa pine is mixed with Douglas-fir, aspen, or true fir (Reynolds and Linkhart 1992). Older pine forests potentially provide larger snags with cavities and typically form open stands with well-developed grass or shrub understories. Most reported nests have been in stands that contain at least some ponderosa pine, which may have been mixed with other species, and were in or adjacent to mature or old-growth stands. Recently, this species has been found in pinyon-juniper stands on the Colorado Plateau that contain no ponderosa pine (McCallum et al. 1994). Surveys for Mexican spotted owls on the SJNF identified flammulated owls that inhabited previously harvested stands of ponderosa pine where large residual trees remained at various densities.

This species shows very high fidelity to breeding sites in Colorado (Reynolds and Linkhart 1987a, 1992). They return to the breeding grounds in May and remain well into October, before fall migration. In Colorado, pairs re-mate in the previous year's territory if both return (Reynolds and Linkhart 1987a). Male

foraging, territorial defense, resting, and day roosting were restricted to a home range that averages 33 acres (Reynolds and Linkhart 1987b). Adjoining home ranges may overlap at their periphery.

Flammulated owls forage intensively near the nest, and open vegetation is preferred for foraging (Reynolds and Linkhart 1987b). In contrast to foraging habitat, which includes numerous interior edges, preferred roosting habitat appears to be dense vegetation (McCallum et al. 1994). Along the Front Range of Colorado, owls roosted in large Douglas-firs or ponderosa pines with sprawling form. Natural predators include great horned owls and accipiters (McCallum et al. 1994). Small birds, from the size of bluebirds and larger, are natural competitors for cavities. These owls are tolerant of humans, nesting close to occupied areas and tolerating observation by flashlight while they are feeding their young. Nest abandonment is rare.

Factors of Concern

Interior and exterior edges appear to be a desirable if not necessary feature of the habitat for the flammulated owl. Open habitat with considerable edge may not only maximize prey density but also facilitate the foraging maneuvers used by this owl. Past management practices have removed some of the larger live and dead trees, including some that would become desirable recruitment sites for future nest cavities. The lack of frequent, low-intensity ground fires has caused a decrease in open stands of pine. Nest site competition is a threat to obligate secondary cavity nesters.

Environmental Baseline

No CBM-related impacts to this species have been documented. There is the potential for undocumented impacts to have occurred from existing CBM development; however, no studies or data are available to make that determination.

Effects of the Alternatives

Alternatives 1, 1A, 1B, 2, and 3 propose the same number and type of wells and facilities near known occurrences of this species. Alternatives 4 and 5 involve construction of fewer wells and facilities near known occurrences. The types of effects to this species are the same among the alternatives and vary only according to the amount of habitat disturbed by each alternative. In general, alternatives that involve more wells and facilities (for example, Alternative 2) are more likely to affect this species and its habitats than are alternatives with fewer wells and facilities (for example, Alternative 5). Table 5 summarizes the amount of disturbance by alternative to habitats for the flammulated owl. Alternative 2 would disturb 2 percent (801 acres) of the habitats in the Project Area, the most by any alternative. Alternative 1 would disturb about 2 percent (455 acres) and 1A would disturb 1 percent. Alternatives 1B, 3, 4, and 5 would each disturb less than 1 percent of the habitats on NFS lands (Table 5).

Potential impacts to the flammulated owl include injury or mortality, disturbance or displacement of adults, destruction of nesting trees, and creation of foraging habitats. Eggs and young within unidentified nests may be injured or killed by construction. Adults would not be harmed because of their ability to avoid areas of human activity. Pre-construction surveys of potential nesting habitats would identify the presence of the owl and would minimize the potential for harm to adults, eggs, or young. Additionally, measures pertaining to snag retention and recruitment would be implemented, minimizing loss of nesting habitat. Increased human presence and construction may disturb or displace adults from nesting and foraging habitats. Although undisturbed habitats exist, their carrying capacity and suitability to support displaced individuals are unknown. These habitats are assumed to occur within the Project Area, and flammulated owls are expected to use these habitats without impacts to individual health or population status. Construction of well pads and other project facilities would create isolated open areas within otherwise closed habitats, including forested habitats. Flammulated owls would benefit from some of these areas

because of their preference to forage for insects in edge and open habitats surrounded by forest. The occurrence and availability of suitable invertebrate prey species would not be altered by implementation of the project.

Within the cumulative effects analysis area, there are 234,355 acres of pinyon-juniper, ponderosa pine, mixed conifer, and aspen habitats for the flammulated owl. Depending on the alternative, between 9,978 and 10,834 acres of these habitats would be cumulatively disturbed by past oil and gas development, the alternatives, and the alternative selected for the SUIT EIS. The cumulative disturbance to these habitats accounts for 4.3 to 4.6 percent of the available habitats in the cumulative effects analysis area for this species. Although it is unlikely that most of these habitats support the flammulated owl, this analysis indicates the relative extent of potential cumulative effects to this species and its habitats. Activities on private lands, such as sand and gravel mining, livestock grazing, agriculture, road construction, and rural and urban housing development, may occur in habitats that support the flammulated owl. The extent of these impacts, and the potential for them to affect this species, are not quantifiable.

Other cumulative effects to the flammulated owl, such as reduced habitat effectiveness, vehicle collision, individual mortality, and habitat fragmentation, may occur but are not quantifiable. These impacts on public and tribal lands are primarily related to oil and gas development and road use; on private lands, residential development is also a major factor. Mitigation measures designed to avoid effects to the flammulated owl from all project activities would be implemented and would minimize the potential for any cumulative effects to this species.

Determination

Implementation of any of the alternatives, as described above, **may adversely impact individuals, but is not likely to result in a loss of viability on the planning area, nor cause a trend towards federal listing or a loss of species viability range wide** for the flammulated owl. This determination is based on the potential for injury or mortality to individuals from removal of mature ponderosa pine and mature conifer from wells, roads, and ancillary facilities. However, there is a low likelihood that these impacts would alter population health or warrant a change in protective status for this species because of the many conservation measures intended to minimize impacts to owl individuals and owl habitat... Specific mitigation measures are described in the EIS that apply to sensitive species and are listed in Section 2.3.2, Project Design Recommendations, of this BE. The following specific mitigation measures apply to the flammulated owl:

- Minimize the number and length of new access roads.
- Construct access roads to new wells as spurs from the existing road system rather than as separate primary access roads where possible.
- Prohibit employees and contractors from bringing dogs or carrying firearms on site.
- Conduct periodic employee and contractor wildlife awareness programs that cover seasonal wildlife requirements and sensitivities, how disturbances affect wildlife, and ways personnel can reduce disturbances.
- Implement a travel management plan on NFS lands that shifts roads currently designated as open to motorized use to a closed designation to help reduce adverse indirect impacts from disturbance.
- Implement effective road closures (to public, motorized uses) to the extent possible on newly developed road systems.
- Remove all contaminants from project sites to avoid exposure to wildlife.

- Fence or cover emergency pits that are connected to each disposal well to prevent animals from drinking any contaminated water.
- Install mufflers or screens on exhaust systems to the extent possible to avoid wildlife entrapment and mortality.
- Minimize disturbance by clearing and otherwise disturbing only vegetation within the minimum area needed for safe and efficient development, production, and maintenance. Extra efforts should be used to avoid disturbance of stands of old-growth ponderosa pine.
- Protect and retain snags and down-dead logs to the extent possible. All snags and logs may be removed from areas of active construction and ground disturbance. Snags and logs outside of disturbance areas should be removed only when they pose a hazard to human life and property.
- Locate well pads, compressors, and other non-linear facilities outside of riparian areas, wetlands, and floodplains to protect the biological and hydrologic features.

Additional Recommendations or Mitigation Measures

A complete list of recommendations and mitigation measures is provided in the EIS. No other measures are suggested for this species.

3.2.13 Lewis' Woodpecker

Species Information

Status

The Lewis' woodpecker is classified as a sensitive species by Region 2 of the FS. The Partners in Flight Conservation Priority Score for this woodpecker is 24, a high priority for national conservation attention (Carter et al. 1996). No information on trends is available for Colorado; the national data indicate a possible downward trend, but the data are unreliable because of high statistical variance (Colorado Bird Observatory 1997).

Distribution

The Lewis' woodpecker breeds throughout much of the western United States (DeGraaf et al. 1991). It winters in the southern half of its breeding range and extends as far south as northern Mexico. In Colorado, it is an uncommon to locally common resident in valley, plains, foothills, and mesas in the southern half of the state (Andrews and Righter 1992). Its typical elevational limit is up to 8,000 feet but may reach 10,000 feet on rare occasions. It has been observed on all districts of the SJNF. The highest nesting densities in Colorado probably occur in the Four Corners area from Dove Creek south to Cortez, east to Wolf Creek Pass, and south to Chromo (Schultz 1996). It is especially common between Pagosa Springs and Durango and along the lower Animas, Florida, Piedra, Pine, and San Juan Rivers. The Durango Bird Club (1992) considers this woodpecker a common year-round resident. Individuals that summer at higher elevations, such as around Williams Creek Reservoir on the Pagosa Ranger District, probably move to lower elevations during winter (Schultz 1996). According to Black and Wood (2003) survey, no suitable nesting habitat was identified on 17 CBM well sites within NFS land. Black and Wood (2003) did observe Lewis' woodpecker along the Piedra River.

This species is expected to occur in the Project Area, although no specific data exist on its population sizes or trends. Within the Project Area, 24,723 acres of grassland, sagebrush, pinyon-juniper, mountain shrub, Gambel oak, ponderosa pine, and riparian/wetland community types on NFS lands may be suitable for the Lewis' woodpecker (Table 4).

Life History

Large ponderosa pine and cottonwoods are the preferred habitat. This woodpecker is a primary cavity nester and depends on snags or dead wood within live trees. It inhabits open country with scattered trees rather than dense forests. There appear to be four critical components of quality habitat on the SJNF: large cottonwoods along riparian zones, large ponderosa pines on surrounding drier slopes, well-developed oak-brush, and large snags or live trees with dead tops and branches for foraging perches and loafing sites (Schultz 1996).

This is one of the most aerial of woodpeckers in its method of feeding during the nesting season. It launches out in a level, graceful glide to catch flying ants, beetles, flies, mayflies, and similar insects before it returns to its perch, much like a flycatcher (Terres 1991). During the non-breeding season, the diet consists of acorns, pinyon nuts, pine seeds, chokecherries, currents, strawberries, juniper berries, and other berries.

Factors of Concern

Protection, retention, and recruitment of snags and live trees with dead tops and "wolf" trees in open forests or forest edges, meadows, and riparian areas with a good understory of grass and shrubs are essential components of habitat for Lewis' woodpecker. Past management practices in the pine type have removed many snags and wolf trees, including some that would have become desirable recruitment sites for nest cavities. The lack of frequent low-intensity ground fires has decreased open stands of pine that are necessary for this woodpecker. Highly desirable snags may need to be protected during prescribed burns, as snags created by fire usually fall within a short time. Management activities that do not encourage colonization by the European starling should be considered.

Environmental Baseline

No CBM-related impacts to this species have been documented. There is the potential for undocumented impacts to have occurred to this species because of CBM development; however, there are no studies to suggest whether impacts have occurred.

Effects of the Alternatives

Alternatives 1, 1A, 1B, 2, and 3 propose the same number and type of wells and facilities near known occurrences of this species. Alternatives 4 and 5 involve construction of fewer wells and facilities near known occurrences. The types of effects to this species are the same among the alternatives and vary only according to the amount of habitat disturbed by each alternative. In general, alternatives that involve more wells and facilities (for example, Alternative 2) are more likely to affect this species and its habitats than are alternatives with fewer wells and facilities (for example, Alternative 5). Table 5 summarizes the amount of disturbance by alternative to habitats for the Lewis' woodpecker. Alternative 2 would disturb 3 percent (821 acres) of the habitats in the Project Area, the most by any alternative. Alternative 1 would disturb about 2 percent (455 acres), and 1A and 4 would each disturb 1 percent. Alternatives 1B, 3, 4, and 5 would each disturb less than 1 percent of the habitats on NFS lands (Table 5).

Potential impacts to the Lewis' woodpecker include injury or mortality, disturbance or displacement of adults, and degradation or destruction of nesting trees. Construction may cause injury or mortality to eggs or young in cavity nests. Adults would not be directly harmed because of their ability to avoid areas of human activity. In addition, increased human presence and construction may disturb or displace adults from nests and foraging habitats. Construction of project facilities may degrade or destroy nesting and foraging habitats. These actions may reduce the condition and availability of snag trees for nesting and hawking. Although undisturbed habitats exist, their carrying capacity and suitability to support displaced

individuals are unknown. These habitats are assumed to occur within the Project Area and Lewis' woodpeckers are expected to use these habitats without impacts to individual health or population status. The occurrence and availability of invertebrate prey species would not be altered by implementation of the project.

Within the cumulative effects analysis area, there are 411,766 acres of grassland, sagebrush, pinyon-juniper, mountain shrub, Gambel oak, ponderosa pine, and riparian/wetland habitats for the Lewis' woodpecker. Depending on alternative, between 21,744 and 22,503 acres of these habitats would be cumulatively disturbed by past oil and gas development, the alternatives, and the alternative selected for the SUIT EIS. The cumulative disturbance to these habitats accounts for 5.3 to 5.5 percent of the available habitats in the cumulative effects analysis area. Although it is unlikely that most of these habitats support the Lewis' woodpecker, this analysis indicates the extent of cumulative effects to this species and its habitat. Activities on private lands, such as sand and gravel mining, livestock grazing, agriculture, road construction, and rural and urban housing development, may occur in habitats that support the Lewis' woodpecker. The extent of these impacts, and the potential for them to affect this species, are not quantifiable.

Other cumulative effects to the Lewis' woodpecker, such as reduced habitat effectiveness, vehicle collision, individual mortality, and habitat fragmentation, may occur but are not quantifiable. The occurrence of these effects on public and tribal lands is primarily related to oil and gas development. Mitigation measures designed to avoid effects to the Lewis' woodpecker from all project activities would be implemented and would minimize the potential for any cumulative effects to this species. Specific mitigation measures are described in the EIS that apply to sensitive species and are listed in Section 2.3.2, Project Design Recommendations, of this BE. The following specific mitigation measures apply to the Lewis' woodpecker:

- Minimize the number and length of new access roads.
- Construct access roads to new wells as spurs from the existing road system rather than as separate primary access roads where possible.
- Prohibit employees and contractors from bringing dogs or carrying firearms on site.
- Conduct periodic employee and contractor wildlife awareness programs that cover seasonal wildlife requirements and sensitivities, how disturbances affect wildlife, and ways personnel can reduce disturbances.
- Implement a travel management plan on NFS lands that shifts roads currently designated as open to motorized use to a closed designation to help reduce adverse indirect impacts from disturbance.
- Implement effective road closures (to public, motorized uses) to the extent possible on newly developed road systems.
- Remove all contaminants from project sites to avoid exposure to wildlife.
- Fence or cover emergency pits that are connected to each disposal well to prevent animals from drinking any contaminated water.
- Install mufflers or screens on exhaust systems to the extent possible to avoid wildlife entrapment and mortality.
- Minimize disturbance by clearing and otherwise disturbing only vegetation within the minimum area needed for safe and efficient development, production, and maintenance. Extra efforts should be used to avoid disturbance of stands of old-growth ponderosa pine.

- Protect and retain snags and down-dead logs to the extent possible. All snags and logs may be removed from areas of active construction and ground disturbance. Snags and logs outside of disturbance areas should be removed only when they pose a hazard to human life and property.
- Locate well pads, compressors, and other non-linear facilities outside of riparian areas, wetlands, and floodplains to protect the biological and hydrologic features.

Determination

Implementation of any of the alternatives, as described above, **may adversely impact individuals, but is not likely to result in a loss of viability on the planning area, nor cause a trend towards federal listing or a loss of species viability range wide** for the Lewis' woodpecker. This determination is based on the implementation of pre-construction surveys in suitable habitats to determine the presence of Lewis' woodpecker within habitats to be disturbed, the potential for suitable, undisturbed habitats to support displaced individuals, and the implementation of additional mitigation measures intended to minimize project impacts.

Additional Recommendations or Mitigation Measures

A complete list of recommendations and mitigation measures is provided in the EIS. No other measures are suggested for this species.

3.2.14 Three-toed Woodpecker

Species Information

Status

The three-toed woodpecker is classified as a sensitive species by Region 2 of the FS. It is an uncommon year-round resident of southwestern Colorado (Durango Bird Club 1992). BBS trend data are unreliable because of high variance (Colorado Bird Observatory 1997).

Distribution

The three-toed woodpecker is circumboreally distributed (Clark et al. 1989). It occurs in North America from northwestern Alaska to Newfoundland, south locally to southeastern Oregon, northern New England, and in the Rocky Mountains to south-central New Mexico and central Arizona (Clark et al. 1989, DeGraaf et al. 1991). There have been no structured forest-wide inventories, but sightings have occurred on all districts on the SJNF. Surveys conducted by Black and Wood (2003) did not reveal the occurrence of three-toes woodpecker on 24 CBM well sites within NFS land. However, it is concluded that this species may occur in suitable habitats in the Project Area, although no data on population size or trend are known to exist. Within the Project Area, 24,852 acres of ponderosa pine, mixed conifer, and aspen community types on NFS lands may be suitable for the three-toed woodpecker (Table 4).

Life History

The three-toed woodpecker is known to be opportunistic and abundant during and after bark beetle outbreaks, but is usually uncommon and relatively inconspicuous (Bock and Bock 1974). Bent (1939) reported it as not common anywhere nor evenly distributed throughout its range and confined to certain limited and favorable localities. The numerical response of this species to beetle infestations exceeds all other sympatric woodpeckers (Koplin 1972). This woodpecker had been considered indigenous to spruce-fir forests but recently has been observed in the montane zone as well (Schmid and Frye 1977).

Its summer elevational range is 8,000 to 11,500 feet. During the winter, it can be found at 6,000 to 11,500 feet. It is primarily found in spruce-fir forests but may be observed in ponderosa pine, Douglas-fir, and lodgepole pine forests when insect populations are high (Andrews and Righter 1992). They have also been found nesting in aspen (Smith 1992).

Approximately 75 percent of the summer diet consists of insects, especially beetles and wood-boring larvae, while the winter diet is 99 percent insects, primarily larvae of the spruce beetle (Towry 1984). Other foods include ants, insect larvae, fruits, mast, and cambium. They may require at least 1,200 to 2,200 larvae per day in winter to satisfy their caloric needs when air temperatures are at freezing (Koplin 1969). They primarily feed by scaling bark rather than pecking, which accounts for their preference for conifers with scaly bark (Clark et al. 1989).

Pair bonding, courtship, and territorial drumming begin in mid- to late-April and nest cavities are excavated by mid-May (Clark et al. 1989). Nest cavities are excavated in trees with heart rot, typically recently dead trees. Night roosts during the breeding season are in cavities in decayed, broken topped, dead trees. Roosting habitat during winter has not been documented. Nest cavities excavated by three-toed woodpeckers are used by a wide variety of secondary cavity-nesting birds long after the woodpeckers have left the area.

Factors of Concern

This species depends on snags for nesting and an adequate source of food such as bark beetles or wood-borers. Larvae of the spruce beetle are a critical source of food during the winter. When substantial numbers of bark beetles are not available, the three-toed woodpecker is uncommon throughout its range, particularly in intensively managed forests.

Environmental Baseline

No CBM-related impacts to this species have been documented. There is the potential for undocumented impacts to have occurred to this species from existing CBM development.

Effects of the Alternatives

Alternatives 1, 1A, 1B, 2, and 3 propose the same number and type of wells and facilities near known occurrences of this species. Alternatives 4 and 5 involve construction of fewer wells and facilities near known occurrences. The types of effects to this species are the same among the alternatives and vary only according to the amount of habitat disturbed by each alternative. In general, alternatives that involve more wells and facilities (for example, Alternative 2) are more likely to affect this species and its habitats than are alternatives with fewer wells and facilities (for example, Alternative 5). Table 5 summarizes the amount of disturbance by alternative to habitats for the three-toed woodpecker. Alternative 2 would disturb 2 percent (590 acres) of the habitats in the Project Area, the most by any alternative. Alternative 1 would disturb about 2 percent (423 acres) and 1A and would disturb 1 percent. Alternatives 1B, 3, 4, and 5 would each disturb less that 1 percent of the habitats on NFS lands (Table 5).

Potential impacts to the three-toed woodpecker from any of the alternatives include injury or mortality, disturbance or displacement of adults, and degradation or destruction of suitable nesting trees. Construction may cause injury or mortality to eggs or young in cavity nests. Adults would not likely be directly harmed because of their ability to avoid areas of human activity. Increased human presence and construction may disturb or displace adults from nesting and foraging habitats. Disturbance or removal of trees that would support bark beetles or wood-boring larvae and may alter the effectiveness of habitats to support this species. The distribution of this species is strongly associated with the occurrence and availabil-

ity of bark beetles and wood-boring insects. Implementation of the project would not affect the status of suitable prey or the overall availability of nesting trees throughout the Project Area, however.

Within the cumulative effects analysis area, there are 57,346 acres of ponderosa pine, mixed conifer, and aspen habitats for the three-toed woodpecker. Depending on alternative, between 1,220 and 1,813 acres of these habitats would be cumulatively disturbed by past oil and gas development, the alternatives, and the alternative selected for the SUIT EIS. The cumulative disturbance to these habitats accounts for 2.1 to 3.2 percent of the available habitats in the cumulative effects analysis area for this species. Although it is unlikely that most of these habitats support the three-toed woodpecker, this analysis indicates the relative extent of cumulative effects to this species and its habitat. Activities on private lands, such as sand and gravel mining, livestock grazing, agriculture, road construction, and rural and urban housing development, may occur in habitats that support the three-toed woodpecker. The extent of these impacts, and the potential for them to affect this species, are not quantifiable.

Other cumulative effects to the three-toed woodpecker, such as reduced habitat effectiveness, vehicle collision, individual mortality, and habitat fragmentation, would occur but are not quantifiable. The level of these effects on public and tribal lands is primarily related to oil and gas development and road use; on private lands, residential development is also a major factor. Mitigation measures designed to avoid effects to the three-toed woodpecker from all project activities would be implemented and would minimize the potential for any cumulative effects to this species. Specific mitigation measures are described in the EIS that apply to sensitive species and are listed in Section 2.3.2, Project Design Recommendations, of this BE. The following specific mitigation measures apply to the three-toed woodpecker:

- Minimize the number and length of new access roads.
- Construct access roads to new wells as spurs from the existing road system rather than as separate primary access roads where possible.
- Prohibit employees and contractors from bringing dogs or carrying firearms on site.
- Conduct periodic employee and contractor wildlife awareness programs that cover seasonal wildlife requirements and sensitivities, how disturbances affect wildlife, and ways personnel can reduce disturbances.
- Implement a travel management plan on NFS lands that shifts roads currently designated as open to motorized use to a closed designation to help reduce adverse indirect impacts from disturbance.
- Implement effective road closures (to public, motorized uses) to the extent possible on newly developed road systems.
- Remove all contaminants from project sites to avoid exposure to wildlife.
- Fence or cover emergency pits that are connected to each disposal well to prevent animals from drinking any contaminated water.
- Install mufflers or screens on exhaust systems to the extent possible to avoid wildlife entrapment and mortality.
- Minimize disturbance by clearing and otherwise disturbing only vegetation within the minimum area needed for safe and efficient development, production, and maintenance. Extra efforts should be used to avoid disturbance of stands of old-growth ponderosa pine.
- Protect and retain snags and down-dead logs to the extent possible. All snags and logs may be removed from areas of active construction and ground disturbance. Snags and logs outside of disturbance areas should be removed only when they pose a hazard to human life and property.

- Locate well pads, compressors, and other non-linear facilities outside of riparian areas, wetlands, and floodplains to protect the biological and hydrologic features.

Determination

Implementation of any of the alternatives, as described above, **may adversely impact individuals, but is not likely to result in a loss of viability on the planning area, nor cause a trend towards federal listing or a loss of species viability range wide** for the three-toed woodpecker. This determination is based on the implementation of pre-construction surveys in suitable habitats that would determine the presence of three-toed woodpecker within habitats to be disturbed and the implementation of additional mitigation measures intended to minimize project impacts.

Additional Recommendations or Mitigation Measures

A complete list of recommendations and mitigation measures is provided in the EIS. No other measures are suggested for this species.

3.2.15 Olive-sided Flycatcher

Species Information

Status

The olive-sided flycatcher is classified as a sensitive species by Region 2 of the FS. The Partners in Flight Conservation Priority Score for this flycatcher is 24 (very high priority). BBS data show significant declines for all continental, national, and regional analyses and for most state and physiographic regions (Altman 1997). Continental declines have been significant (4 percent), with extremely low variance (Colorado Bird Observatory 1997). BBS trend data for Colorado are inconclusive because of high variance.

Distribution

The primary wintering range of the olive-sided flycatcher, a long-range neotropical migrant, is in Panama and the Andes Mountains of northern and western South America. This flycatcher breeds in the western United States and across Canada (Altman 1997). In Colorado, the olive-sided flycatcher is a montane summer resident found at elevations between 7,000 and 11,000 feet (Andrews and Righter 1992). It occurs on all districts of the SJNF and is classified as a common nester by the Durango Bird Club (1992). There have been no structured forest-wide inventories specifically for this species. Surveys conducted by Black and Wood (2003) did not reveal the occurrence of olive-sided flycatcher on 24 CBM well sites within NFS land. However, this species is known to occur in suitable habitats in the Project Area, although no data on population size or trends are known to exist.

Within the Project Area, 24,878 acres of ponderosa pine, mixed conifer, aspen, and riparian/wetland community types on NFS lands may be suitable for the olive-sided flycatcher (Table 4).

Life History

Breeding habitats in western states for the olive-sided flycatcher are primarily mature spruce-fir, Douglas fir and, less often, other coniferous forests, and montane and foothill riparian and aspen forests in the 7,000 to 11,000 feet elevational range (Andrews and Righter 1992). Within these habitats, this species occurs primarily: (1) within forest burns where snags or tall, residual live trees remain; (2) near water along the wooded shores of streams, lakes, rivers, beaver ponds, bogs and muskegs, often where standing dead trees are present; (3) at forest edges near natural or man-made openings in the forest; and (4) in open

or semi-open forest stands with a low percentage of canopy cover, rather than in the forest interior or beneath the forest canopy (Altman 1997). Additional important habitat in the western mountains includes scree or talus slopes with forest patches or clumps of tall trees and steep canyon walls with tall perches that provide wide-ranging vistas above the surrounding forest canopy. Tall trees, trees with spiked tops or high, conspicuous dead branches and dead snags, as well as adequate live trees for nesting sites, are important components of nesting habitats. The affinity for unusually large trees for perching may be a limiting factor in their abundance and distribution (Finch 1992).

The olive-sided flycatcher is an aerial insectivore that forages from a high prominent perch, mostly at the top of a snag or the dead tip or uppermost branch of the tallest trees, where it flies out (sallying or hawking) to capture a flying insect, and then returns to the same or another prominent perch. Unlike other flycatchers, it is entirely restricted to sallying or hawking for prey (Eckhardt 1979). Its foraging behavior requires exposed perches and unobstructed air space; thus, tall trees and open canopy provide a better environment than closed canopy forest. Bees, wasps, and flying ants make up a high percentage of its diet.

Factors of Concern

Loss of wintering habitat in Central America has been implicated as an important contributor to the widespread decline of this flycatcher (Dobkin 1992). Loss of preferred perches, such as tall snags, spiked tops, or high, conspicuous dead branches in the overstory could reduce the suitability of habitat. Reductions in habitat with a low percentage of canopy cover or edges where there is juxtaposition of late and early successional forest may be harmful to this species.

Environmental Baseline

No CBM-related impacts to this species have been documented. There is the potential for undocumented impacts to have occurred to this species from existing CBM development; however, no data exist to show that undocumented impacts have occurred.

No other impacts to this species have been documented; however, it is likely that this species has been affected in the past by human presence and disturbance to nesting and foraging habitats in the Project Area.

Effects of the Alternatives

Alternatives 1, 1A, 1B, 2, and 3 propose the same number and type of wells and facilities near known occurrences of this species. Alternatives 4 and 5 involve construction of fewer wells and facilities near known occurrences. The types of effects to this species are the same among the alternatives and vary only according to the amount of habitat disturbed by each alternative. In general, alternatives that involve more wells and facilities (for example, Alternative 2) are more likely to affect this species and its habitats than are alternatives with fewer wells and facilities (for example, Alternative 5). Table 5 summarizes the amount of disturbance by alternative to habitats for the olive-sided flycatcher. Alternative 2 would disturb 2 percent (590 acres) of the habitats in the Project Area, the most by any alternative. Alternative 1 would disturb about 2 percent (423 acres) and 1A and would disturb 1 percent. Alternatives 1B, 3, 4, and 5 would each disturb less that 1 percent of the habitats on NFS lands (Table 5).

Potential impacts to the olive-sided flycatcher from any of the alternatives include injury or mortality, disturbance or displacement of individuals, and degradation or destruction of habitats. Construction may cause injury or mortality to eggs or young in unidentified nests. Adults would not be directly harmed because of their ability to avoid areas of human activity. Increased human presence and construction may disturb or displace adults from nesting and foraging habitats. Trees that are suitable for hawking insects have been identified as a potential limiting factor for the occurrence of this species. Construction may

disturb or destroy these and other mature trees in the Project Area. Reduced availability or suitability of this already limited resource may further restrict the occurrence of this species in the Project Area. The occurrence and availability of invertebrate prey species would not be impacted by the project.

Within the cumulative effects analysis area, there are 66,175 acres of ponderosa pine, mixed conifer, aspen, and riparian/wetland habitats for the olive-sided flycatcher. Depending on alternative, between 1,714 and 2,307 acres of these habitats would be cumulatively disturbed by past oil and gas development, the alternatives to the proposed project, and the alternative selected for the SUIT EIS. The cumulative disturbance to these habitats accounts for 2.6 to 3.5 percent of the available habitats in the cumulative effects analysis area for this species. Although it is unlikely that most of these habitats support the olive-sided flycatcher, this analysis indicates the extent of cumulative effects to this species and its habitats. Activities on private lands, such as sand and gravel mining, livestock grazing, agriculture, road construction, and rural and urban housing development, may occur in habitats that support the olive-sided flycatcher. The extent of these impacts, and the potential for them to affect this species, are not quantifiable.

Other cumulative effects to the olive-sided flycatcher, such as reduced habitat effectiveness, vehicle collision, individual mortality, and habitat fragmentation, would occur but are not quantifiable. The level of these effects on public and tribal lands is primarily related to oil and gas development and road use; on private lands, residential development is also a major factor. For this reason, a trend similar to effects on habitat is expected for these effects. Mitigation measures designed to avoid effects to the olive-sided flycatcher from all project activities would be implemented and would minimize the potential for cumulative effects to this species. Specific mitigation measures are described in the EIS that apply to sensitive species and are listed in Section 2.3.2, Project Design Recommendations, of this BE. The following specific mitigation measures apply to the olive-sided flycatcher:

- Minimize the number and length of new access roads.
- Construct access roads to new wells as spurs from the existing road system rather than as separate primary access roads where possible.
- Prohibit employees and contractors from bringing dogs or carrying firearms on site.
- Conduct periodic employee and contractor wildlife awareness programs that cover seasonal wildlife requirements and sensitivities, how disturbances affect wildlife, and ways personnel can reduce disturbances.
- Implement a travel management plan on NFS lands that shifts roads currently designated as open to motorized use to a closed designation to help reduce adverse indirect impacts from disturbance.
- Implement effective road closures (to public, motorized uses) to the extent possible on newly developed road systems.
- Remove all contaminants from project sites to avoid exposure to wildlife.
- Fence or cover emergency pits that are connected to each disposal well to prevent animals from drinking any contaminated water.
- Install mufflers or screens on exhaust systems to the extent possible to avoid wildlife entrapment and mortality.
- Minimize disturbance by clearing and otherwise disturbing only vegetation within the minimum area needed for safe and efficient development, production, and maintenance. Extra efforts should be used to avoid disturbance of stands of old-growth ponderosa pine.

- Protect and retain snags and down-dead logs to the extent possible. All snags and logs may be removed from areas of active construction and ground disturbance. Snags and logs outside of disturbance areas should be removed only when they pose a hazard to human life and property.
- Locate well pads, compressors, and other non-linear facilities outside of riparian areas, wetlands, and floodplains to protect the biological and hydrologic features.

Determination

Implementation of any of the alternatives, as described above, **may adversely impact individuals, but is not likely to result in a loss of viability on the planning area, nor cause a trend towards federal listing or a loss of species viability range wide** for the olive-sided flycatcher. This determination is based on the implementation of pre-construction surveys in suitable habitats that would determine the presence of olive-sided flycatchers within habitats to be disturbed and the implementation of additional mitigation measures intended to minimize project impacts.

Additional Recommendations or Mitigation Measures

A complete list of recommendations and mitigation measures is provided in the EIS. No other measures are suggested for this species.

3.2.16 Purple Martin

Species Information

Status

The purple martin is classified as a sensitive species by Region 2 of the FS. BBS data show a stable or increasing trend for the western and central United States, but a possible decline in the Northern Rockies (Colorado Bird Observatory 1997).

Distribution

The purple martin is a long-distance, neotropical migrant that winters in South America (DeGraaf et al. 1991). The breeding range is across North America from the Atlantic to the Pacific coasts and from southern Canada to central Mexico. It occurs locally in the Rocky Mountains but avoids most other mountainous areas.

The purple martin is a common summer resident in the lower mountains of west-central Colorado (Andrews and Richter 1992). In southwestern Colorado, it is an uncommon cavity nester at elevations between 6,500 and 10,000 feet (Andrews and Richter 1992; Durango Bird Club 1992). Nests in aspen cavities have been reported in western Colorado, including La Plata, Montezuma, Rio Blanco, and Dolores Counties (Svobada et al. 1980). As of 1997, five active sites have been found on the Mancos-Dolores Ranger District, and Archuleta County is a probable breeding area (Andrews and Richter 1992). No structured forest-wide inventories have been conducted for the purple martin. Surveys conducted by Black and Wood (2003) did not reveal any occurrences of purple martin on 24 CBM well sites within NFS land. However, it is concluded that this species may occur in the Project Area, although no data on population size or trend are known to exist.

Within the Project Area, 24,878 acres of ponderosa pine, mixed conifer, aspen, and riparian/wetland community types on NFS lands may be suitable for the purple martin (Table 4).

Life History

Reynolds et al. (1991) studied 18 purple martin nests on the Grand Mesa National Forest in western Colorado, the only detailed study for this species in Colorado. Adults arrived in breeding areas by early June and flocked in preparation for departure by late August. All nests but one were in mature aspen stands. Although aspen forest is the typical breeding habitat for this species, it also may be found in mixed aspen/ponderosa pine or aspen/Douglas-fir forests (Andrews and Righter 1992). Nests were more frequently found in live aspen rather than in snags and in cavities excavated by northern flickers (Reynolds et al. 1991). All nests were within 1,000 feet of water, which included small creeks and stock ponds. During migration, martins occur over riparian areas, open agricultural areas, and reservoirs.

Purple martins forage aerially in prolonged flight, capturing flying insects for most of their diet, but will occasionally feed on the ground, taking ants and other insects (Dobkin 1992). There is no evidence that they are a cowbird host, but there is nest site competition with starlings and house sparrows (National Geographic Society 1987; Ehrlich et al. 1988).

Factors of Concern

Loss of mature aspen stands with parklands and water sources nearby could reduce the availability of suitable habitat for purple martins.

Environmental Baseline

No CBM-related impacts to this species have been documented. There is the potential for undocumented impacts to have occurred to this species from existing CBM development; however, no data exist to show that undocumented impacts have occurred.

No other impacts to this species have been documented; however, it is likely that this species has been affected in the past by human presence and disturbance to nesting and foraging habitats within the Project Area.

Effects of the Alternatives

Alternatives 1, 1A, 1B, 2, and 3 propose the same number and type of wells and facilities near known occurrences of this species. Alternatives 4 and 5 involve construction of fewer wells and facilities near known occurrences. The types of effects to this species are the same among the alternatives and vary only according to the amount of habitat disturbed by each alternative. In general, alternatives that involve more wells and facilities (for example, Alternative 2) are more likely to affect this species and its habitats than are alternatives with fewer wells and facilities (for example, Alternative 5). Table 5 summarizes the amount of disturbance by alternative to habitats for the purple martin. Alternative 2 would disturb 2 percent (590 acres) of the habitats in the Project Area, the most by any alternative. Alternative 1 would disturb about 2 percent (423 acres) and 1A and would disturb 1 percent. Alternatives 1B, 3, 4, and 5 would each disturb less that 1 percent of the habitats on NFS lands (Table 5).

Potential impacts to the purple martin caused by the alternatives include injury or mortality, disturbance or displacement of adults, and degradation or destruction of nesting trees. Construction activities may cause injury or mortality to eggs or young in cavity nests. Adults would not be harmed because of their ability to avoid areas of human activity. Increased human presence and construction may disturb or displace adults from nesting and foraging habitats. Construction may degrade or destroy suitable trees for cavity nesting. Purple martin prefer to nest in aspen stands that are within 1,000 feet of water. Disturbance of these limited habitats may affect the occurrence and distribution of this species within the Project Area. The occurrence and availability of invertebrate prey species would not be impacted by the project.

Within the cumulative effects analysis area, there are 66,175 acres of ponderosa pine, mixed conifer, aspen, and riparian/wetland habitats for the purple martin. Depending on alternative, between 1,714 and 2,307 acres of these habitats would be cumulatively disturbed by past oil and gas development, the alternatives to the proposed project, and the alternative selected for the SUIT EIS. The cumulative disturbance to these habitats accounts for 2.6 to 3.5 percent of the available habitats in the cumulative effects analysis area. Although it is unlikely that most of these habitats support the purple martin, this analysis indicates the extent of cumulative effects to this species and its habitat. Activities on private lands, such as sand and gravel mining, livestock grazing, agriculture, road construction, and rural and urban housing development, may occur in habitats that support the purple martin. The extent of these impacts, and the potential for them to affect this species, are not quantifiable.

Other cumulative effects to the purple martin, such as reduced habitat effectiveness, vehicle collision, individual mortality, and habitat fragmentation, would occur but are not quantifiable. The level of these effects on public and tribal lands is primarily related to oil and gas development and road use; on private lands, residential development is also a major factor. For this reason, a trend similar to the effects examined for habitat is expected. Mitigation measures designed to avoid effects to the purple martin from all project activities would be implemented and would minimize the potential for any cumulative effects to this species. Specific mitigation measures are described in the EIS that apply to sensitive species and are listed in Section 2.3.2, Project Design Recommendations, of this BE. The following specific mitigation measures apply to the purple martin:

- Minimize the number and length of new access roads.
- Construct access roads to new wells as spurs from the existing road system rather than as separate primary access roads where possible.
- Prohibit employees and contractors from bringing dogs or carrying firearms on site.
- Conduct periodic employee and contractor wildlife awareness programs that cover seasonal wildlife requirements and sensitivities, how disturbances affect wildlife, and ways personnel can reduce disturbances.
- Implement a travel management plan on NFS lands that shifts roads currently designated as open to motorized use to a closed designation to help reduce adverse indirect impacts from disturbance.
- Implement effective road closures (to public, motorized uses) to the extent possible on newly developed road systems.
- Remove all contaminants from project sites to avoid exposure to wildlife.
- Fence or cover emergency pits that are connected to each disposal well to prevent animals from drinking any contaminated water.
- Install mufflers or screens on exhaust systems to the extent possible to avoid wildlife entrapment and mortality.
- Minimize disturbance by clearing and otherwise disturbing only vegetation within the minimum area needed for safe and efficient development, production, and maintenance. Extra efforts should be used to avoid disturbance of stands of old-growth ponderosa pine.
- Protect and retain snags and down-dead logs to the extent possible. All snags and logs may be removed from areas of active construction and ground disturbance. Snags and logs outside of disturbance areas should be removed only when they pose a hazard to human life and property.
- Locate well pads, compressors, and other non-linear facilities outside of riparian areas, wetlands, and floodplains to protect the biological and hydrologic features.

Determination

Implementation of any of the alternatives, as described above, **may adversely impact individuals, but is not likely to result in a loss of viability on the planning area, nor cause a trend towards federal listing or a loss of species viability range wide** for the purple martin. This determination is based on implementation of pre-construction surveys in suitable habitats and of additional mitigation measures intended to minimize project impacts.

Additional Recommendations or Mitigation Measures

A complete list of recommendations and mitigation measures is provided in the EIS. No other measures are suggested for this species.

3.2.17 Pygmy Nuthatch

Species Information

Status

The pygmy nuthatch is classified as a sensitive species by Region 2 of the FS. BBS data at the continental scale indicate a slightly increasing trend (Colorado Bird Observatory 1997). Data for Colorado are inadequate for determination of a trend.

Distribution

The geographical distribution of the pygmy nuthatch coincides closely with ponderosa pine forests of western North America. This same habitat type is used throughout the year (DeGraaf et al. 1991). This species is expected to occur in suitable habitats in the Project Area, although no data on population size or trend are known to exist. Within the Project Area, 24,878 acres of ponderosa pine, mixed conifer, aspen, and riparian/wetland community types on NFS lands may be suitable for the pygmy nuthatch (Table 4). Surveys conducted by Black and Wood (2003) found the pygmy nuthatch to be fairly common in ponderosa pine forests, especially those in proximity to Goose and Ignacio Creeks.

Life History

This gregarious cavity nester inhabits mature ponderosa pine communities (Scott 1979; Scott et al. 1977), preferring open park-like stands with 40 to 70 percent crown cover (Rosenstock 1996; Clark et al. 1989). They will also use aspen for nesting and will wander less often to spruce-fir, mixed conifer (Douglas-fir), pinyon-juniper woodlands, and lowland riparian forests. (Andrews and Righter 1992; Towry 1984). Pygmy nuthatches travel in small family flocks after nesting in the summer but congregate in large numbers by fall and winter (Terres 1991). Each breeding pair occupies a territory of about 5 acres (Clark et al. 1989).

Pygmy nuthatches nest and roost in natural cavities or cavities excavated by other birds. Cavities tend to be located at the top of a snag or on the underside of a dead branch (DeGraaf et al. 1991). This nuthatch is primarily insectivorous, gleaning prey from surfaces of bark, but will also eat conifer seeds (DeGraaf et al. 1991, Scott et al. 1977, Balda 1975). It forages on branches, outermost twigs, trunks, and pine cones (Terres 1991). Bark and leaf beetles are important dietary components (Clark et al. 1989).

Factors of Concern

Management activities that do not provide an adequate range in the quality of snags or cavities may affect the overall biology of the nuthatch, its survivorship, and reproduction (Hay and Guntert 1983). Recruit-

ment of larger trees for future snags in areas where management activities occur may be necessary. The lack of frequent low-intensity ground fires has created dense stands of smaller-diameter pine. Highly desirable snags may need to be protected during prescribed burns, as snags created by fire usually fall within a short time.

Environmental Baseline

No CBM-related impacts to this species have been documented. There is the potential for undocumented impacts to have occurred to this species from existing CBM development; however, no data exist to show that undocumented impacts have occurred.

No other impacts to this species have been documented; however, it is likely that this species has been affected in the past by human presence and disturbance to nesting and foraging habitats within the Project Area.

Effects of the Alternatives

Alternatives 1, 1A, 1B, 2, and 3 propose the same number and type of wells and facilities near known occurrences of this species. Alternatives 4 and 5 involve construction of fewer wells and facilities near known occurrences. The types of effects to this species are the same among the alternatives and vary only according to the amount of habitat disturbed by each alternative. In general, alternatives that involve more wells and facilities (for example, Alternative 2) are more likely to affect this species and its habitats than are alternatives with fewer wells and facilities (for example, Alternative 5). Table 5 summarizes the amount of disturbance by alternative to habitats for the pygmy nuthatch. Alternative 2 would disturb 2 percent (590 acres) of the habitats in the Project Area, the most by any alternative. Alternative 1 would disturb about 2 percent (423 acres) and 1A and would disturb 1 percent. Alternatives 1B, 3, 4, and 5 would each disturb less that 1 percent of the habitats on NFS lands (Table 5).

Potential impacts to the pygmy nuthatch caused by implementation of any of the alternatives include injury or mortality, disturbance or displacement of adults, and degradation or destruction of habitats. Construction may cause injury or mortality to eggs or young in nests. Adults would not likely be directly harmed because of their ability to avoid areas of human activity. Increased human presence and construction may disturb or displace adults from nesting and foraging habitats. Construction may degrade or destroy trees with cavities and trees that may become nesting sites. Although undisturbed habitats exist, their carrying capacity and suitability to support displaced individuals are unknown. These habitats are assumed to occur within the Project Area, and pygmy nuthatch are expected to use these habitats without impacts to individual health or population status. Implementation of the project would not affect the occurrence or availability of invertebrate prey for the pygmy nuthatch.

Within the cumulative effects analysis area, there are 66,175 acres of ponderosa pine, mixed conifer, aspen, and riparian/wetland habitats for the pygmy nuthatch. Depending on alternative, between 1,714 and 2,307 acres of these habitats would be cumulatively disturbed by past oil and gas development, the alternatives to the proposed project, and the alternative selected for the SUIT EIS. The cumulative disturbance to these habitats accounts for 2.6 to 3.5 percent of the available habitats in the cumulative effects analysis area. Although it is unlikely that most of these habitats support the pygmy nuthatch, this analysis indicates the extent of potential cumulative effects to this species and its habitat. Activities on private lands, such as sand and gravel mining, livestock grazing, agriculture, road construction, and rural and urban housing development, may occur in habitats that support the pygmy nuthatch. The extent of these impacts, and the potential for them to affect this species, are not quantifiable.

Other cumulative effects to the pygmy nuthatch, such as reduced habitat effectiveness, vehicle collision, individual mortality, and habitat fragmentation, would occur but are not quantifiable. The level of these effects on public and tribal lands is primarily related to oil and gas development and road use; on private lands, residential development is also a major factor. For this reason, a trend similar to the effects examined for habitat is expected. Mitigation measures designed to avoid effects to the pygmy nuthatch from all project activities would be implemented and would minimize the potential for any cumulative effects to this species. Specific mitigation measures are described in the EIS that apply to sensitive species and are listed in Section 2.3.2, Project Design Recommendations, of this BE. The following specific mitigation measures apply to the pygmy nuthatch:

- Minimize the number and length of new access roads.
- Construct access roads to new wells as spurs from the existing road system rather than as separate primary access roads where possible.
- Prohibit employees and contractors from bringing dogs or carrying firearms on site.
- Conduct periodic employee and contractor wildlife awareness programs that cover seasonal wildlife requirements and sensitivities, how disturbances affect wildlife, and ways personnel can reduce disturbances.
- Implement a travel management plan on NFS lands that shifts roads currently designated as open to motorized use to a closed designation to help reduce adverse indirect impacts from disturbance.
- Implement effective road closures (to public, motorized uses) to the extent possible on newly developed road systems.
- Remove all contaminants from project sites to avoid exposure to wildlife.
- Fence or cover emergency pits that are connected to each disposal well to prevent animals from drinking any contaminated water.
- Install mufflers or screens on exhaust systems to the extent possible to avoid wildlife entrapment and mortality.
- Minimize disturbance by clearing and otherwise disturbing only vegetation within the minimum area needed for safe and efficient development, production, and maintenance. Extra efforts should be used to avoid disturbance of stands of old-growth ponderosa pine.
- Protect and retain snags and down-dead logs to the extent possible. All snags and logs may be removed from areas of active construction and ground disturbance. Snags and logs outside of disturbance areas should be removed only when they pose a hazard to human life and property.
- Locate well pads, compressors, and other non-linear facilities outside of riparian areas, wetlands, and floodplains to protect the biological and hydrologic features.

Determination

Implementation of any of the alternatives, as described above, **may adversely impact individuals, but is not likely to result in a loss of viability on the planning area, nor cause a trend towards federal listing or a loss of species viability range wide** for the pygmy nuthatch. This determination is based on implementation of pre-construction surveys in suitable habitats and of additional mitigation measures intended to minimize project impacts.

Additional Recommendations or Mitigation Measures

A complete list of recommendations and mitigation measures is provided in the EIS. No other measures are suggested for this species.

3.2.18 Golden-crowned Kinglet

Species Information

Status

The golden-crowned kinglet is classified as a sensitive species by Region 2 of the FS. BBS data indicate a possible declining trend in the population on a continental scale (Colorado Bird Observatory 1997).

Distribution

Golden-crowned kinglets have a large range of occurrence. They breed in mountainous regions of western North America, across Canada, and in the northern half of eastern North America, but they are conspicuously absent from the Great Plains and South. This species winters throughout much of the United States (DeGraaf et al. 1991). Within Colorado, golden-crowned kinglets are considered residents of higher mountains. They are uncommon to fairly common in summer and rare in the winter (Andrews and Righter 1992). This species seems to be more common west of the continental divide than to the east. This species has been observed within the spruce-fir zone throughout the SJNF. Surveys conducted by Black and Wood (2003) did not reveal the occurrence of golden-crowned kinglet within (north-facing) mixed conifer woodland. However, it is known to breed on the SJNF, and may occur in small numbers in suitable habitats in the Project Area.

Within the Project Area, 33,273 acres of pinyon-juniper, ponderosa pine, mixed conifer, and riparian/wetland community types on NFS lands may be suitable for the golden-crowned kinglet (Table 4).

Life History

The golden-crowned kinglet breeds primarily in mature, dense spruce-fir forest, and rarely in limber pine and Douglas-fir. In winter, it occurs in coniferous forests (especially Douglas-fir and ponderosa pine) but also in other types such as pinyon-juniper woodlands, foothill and lowland riparian forests, and in planted conifers in parks, cemeteries, and residential areas in the lowlands. In migration, it is found in most wooded habitats (Andrews and Righter 1992). It seems tolerant of ecological change in its winter and migratory habitats but is intolerant to disturbances on its nesting grounds. No limiting factors have been documented for the golden-crowned kinglet except for disturbances in local nesting habitat.

Factors of Concern

As a late-successional spruce-fir forest species that feeds on insects, this species could be negatively impacted by removal of trees that would reduce the canopy cover and subsequently the availability of insects. Based on the work of Carter (1995), it would appear that a reduction below 40 percent canopy cover might cross the threshold and create a negative impact to the species.

Environmental Baseline

No CBM-related impacts to this species have been documented. There is the potential for undocumented impacts to have occurred to this species from existing CBM development; however, no data exist to show that undocumented impacts have occurred.

No other impacts to this species have been documented; however, it is likely that this species has been affected in the past by human presence and disturbance to suitable nesting and foraging habitats within the Project Area.

Effects of the Alternatives

Alternatives 1, 1A, 1B, 2, and 3 propose the same number and type of wells and facilities near known occurrences of this species. Alternatives 4 and 5 involve construction of fewer wells and facilities near known occurrences. The types of effects to this species are the same among the alternatives and vary only according to the amount of habitat disturbed by each alternative. In general, alternatives that involve more wells and facilities (for example, Alternative 2) are more likely to affect this species and its habitats than are alternatives with fewer wells and facilities (for example, Alternative 5). Table 5 summarizes the amount of disturbance by alternative to golden-crowned kinglet winter habitats. Alternative 2 would disturb 2 percent (776 acres) of the habitats in the Project Area, the most by any alternative. Alternative 1 would disturb about 2 percent (523 acres) and 1A and would disturb 1 percent. Alternatives 1B, 3, 4, and 5 would each disturb less that 1 percent of the habitats on NFS lands (Table 5).

Potential impacts to the golden-crowned kinglet from any of the alternatives include injury or mortality, disturbance or displacement of adults, and degradation or destruction of habitats. Construction is unlikely to cause injury or mortality to eggs or young in unidentified nests because the species breeds in spruce-fir forests and not in the ponderosa pine or pinyon-juniper forests that are typical of the Project Area. Adults would not likely be harmed because of their ability to avoid areas of human activity. Increased human presence and construction may disturb or displace adults from foraging habitats.

Construction may change localized stand structure and canopy closure by disturbing and removing mature trees. Alteration of stand and canopy conditions within localized forest patches may alter the occurrence and availability of preferred invertebrate prey species. Although suitable, undisturbed wintering habitats exist, their carrying capacity and suitability to support displaced individuals are unknown. These wintering habitats are assumed to occur within the Project Area, and golden-crowned kinglets are expected to use these habitats without impacts to individual health or population status.

Within the cumulative effects analysis area, there are 241,866 acres of pinyon-juniper, ponderosa pine, mixed conifer, and riparian/wetland habitats for the golden-crowned kinglet. Depending on alternative, between 10,473 and 11,301 acres of these habitats would be cumulatively disturbed by past oil and gas development, the alternatives to the proposed project, and the alternative selected for the SUIT EIS. The cumulative disturbance to these habitats accounts for 4.3 to 4.7 percent of the available habitats in the cumulative effects analysis area. Although it is unlikely that most of these habitats support the golden-crowned kinglet, this analysis indicates the extent of potential cumulative effects to this species and its wintering habitat. Activities on private lands, such as sand and gravel mining, livestock grazing, agriculture, road construction, and rural and urban housing development, may occur in habitats that support the golden-crowned kinglet. The extent of these impacts, and the potential for them to affect this species, are not quantifiable.

Other cumulative effects to the golden-crowned kinglet, such as reduced habitat effectiveness, vehicle collision, individual mortality, and habitat fragmentation, would occur but are not quantifiable. The level of these effects on public and tribal lands is primarily related to oil and gas development and road use; on private lands, residential development is also a major factor. For this reason, a trend similar to the effects examined for habitat is expected. Specific mitigation measures are described in the EIS that apply to sensitive species and are listed in Section 2.3.2, Project Design Recommendations, of this BE. The following specific mitigation measures apply to the golden-crowned kinglet:

- Minimize the number and length of new access roads.
- Construct access roads to new wells as spurs from the existing road system rather than as separate primary access roads where possible.
- Prohibit employees and contractors from bringing dogs or carrying firearms on site.
- Conduct periodic employee and contractor wildlife awareness programs that cover seasonal wildlife requirements and sensitivities, how disturbances affect wildlife, and ways personnel can reduce disturbances.
- Implement a travel management plan on NFS lands that shifts roads currently designated as open to motorized use to a closed designation to help reduce adverse indirect impacts from disturbance.
- Implement effective road closures (to public, motorized uses) to the extent possible on newly developed road systems.
- Remove all contaminants from project sites to avoid exposure to wildlife.
- Fence or cover emergency pits that are connected to each disposal well to prevent animals from drinking any contaminated water.
- Install mufflers or screens on exhaust systems to the extent possible to avoid wildlife entrapment and mortality.
- Minimize disturbance by clearing and otherwise disturbing only vegetation within the minimum area needed for safe and efficient development, production, and maintenance. Extra efforts should be used to avoid disturbance of stands of old-growth ponderosa pine.
- Protect and retain snags and down-dead logs to the extent possible. All snags and logs may be removed from areas of active construction and ground disturbance. Snags and logs outside of disturbance areas should be removed only when they pose a hazard to human life and property.
- Locate well pads, compressors, and other non-linear facilities outside of riparian areas, wetlands, and floodplains to protect the biological and hydrologic features.

Determination

Implementation of any of the alternatives, as described above, **may adversely impact individuals, but is not likely to result in a loss of viability on the planning area, nor cause a trend towards federal listing or a loss of species viability range wide** for the golden-crowned kinglet. This determination is based on the potential for injury or mortality to individuals and the low likelihood that these impacts would alter population health or warrant a change in protective status for this species.

Additional Recommendations or Mitigation Measures

A complete list of recommendations and mitigation measures is provided in the EIS. No other measures are suggested for this species.

3.2.19 Loggerhead Shrike

Species Information

Status

The loggerhead shrike is classified as a sensitive species by Region 2 of the FS. BBS data show a strong continental decline, in excess of 3 percent per year. Data for Colorado indicate that declines may also be occurring at the state level.

Distribution

This species breeds throughout much of the United States, north into Canada, and south into Mexico. It winters primarily from the central and southern parts of breeding range south to Mexico (DeGraaf et al. 1991). In Colorado, Andrews and Righter (1992) considered the species a resident that was common in the eastern plains in winter and rare or uncommon in other areas and seasons. For the SJNF, this species is considered a non-breeder and an occasional winter visitor. It is classified as an uncommon year-round resident by the Durango Bird Club (1992). This species may occur at low densities in the Project Area, although no data suggest that this is the case. Within the Project Area, 14,327 acres of grassland, sagebrush, pinyon-juniper, and barren community types on NFS lands may be suitable for the loggerhead shrike (Table 4).

Life History

Non-breeding habitat is the more open country from prairies and agricultural lands to montane meadows. Nesting habitat includes sagebrush, desert scrub, pinyon-juniper woodlands, and woodland edges (Johnsgard 1986). Breeding birds are usually near isolated trees or large shrubs. They nest earlier than most other passerines. Nests are bulky, cup-shaped, and located in trees or large shrubs 3 to 30 feet high (Ehrlich et al. 1988). Nests are well below the crown in a crotch or large branch and are typically well hidden.

The diet of the loggerhead shrike is composed mostly of insects (83 percent), with the remainder made up of small mammals, birds, and reptiles. Sometimes it hawks for aerial insects, but it takes most of its prey as it dives to the ground from elevated perches such as fence posts or utility lines (DeGraaf et al. 1991). It may pursue birds in rapid, sustained flight, knocking them to the ground with a blow from the beak.

Factors of Concern

Removal of scattered trees and large shrubs in open country could have a negative impact on nesting and perching needs of this species. Habitat loss from land-use conversion and development may contribute to the decline of this species.

Environmental Baseline

No CBM-related impacts to this species have been documented. There is the potential for undocumented impacts to have occurred to this species from existing CBM development; however, no data exist to show that undocumented impacts have or have not occurred.

No other impacts to this species have been documented; however, it is likely that this species has been affected in the past by human presence and disturbance to habitats within the Project Area.

Effects of the Alternatives

Alternatives 1, 1A, 1B, 2, and 3 propose the same number and type of wells and facilities near known occurrences of this species. Alternatives 4 and 5 involve construction of fewer wells and facilities near known occurrences. The types of effects to this species are the same among the different alternatives and vary only according to the amount of habitat disturbed by each alternative. In general, alternatives that involve more wells and facilities (for example, Alternative 2) are more likely to affect this species and its habitats than are alternatives with fewer wells and facilities (for example, Alternative 5). Table 5 summarizes the amount of disturbance by alternative to habitats for the loggerhead shrike. Alternative 2 would disturb 2 percent (316 acres) of the habitats in the Project Area, the most by any alternative. Alternative 1 would disturb 1 percent and Alternatives 1A, 1B, 3, 4, and 5 would each disturb less that 1 percent of the habitats on NFS lands (Table 5).

Potential impacts to the loggerhead shrike caused by implementation of any of the alternatives include disturbance or displacement of individuals and degradation or destruction of foraging habitats. Increased human presence and construction may disturb or displace foraging individuals. Construction of project facilities, including well pads and associated infrastructure, may degrade or destroy foraging habitats. Although undisturbed habitats exist within the Project Area, their carrying capacity and suitability to support displaced individuals are unknown. These habitats are assumed to occur within the Project Area, and loggerhead shrikes are expected to use these habitats without impacts to individual health or population status. Project activities are not expected to impact the occurrence or availability of prey species for the loggerhead shrike.

Within the cumulative effects analysis area, there are 355,881 acres of grassland, sagebrush, pinyon-juniper, and barren habitats for the loggerhead shrike. Depending on alternative, between 19,530 and 19,997 acres of these habitats would be cumulatively disturbed by past oil and gas activities, the alternatives to the proposed project, and the selected alternative for the SUIT EIS. The cumulative disturbance to these habitats accounts for 5.5 to 5.6 percent of the available habitats in the cumulative effects analysis area. Although it is unlikely that most of these habitats support the loggerhead shrike, this analysis indicates the extent of cumulative effects to this species and its habitat. Activities on private lands, such as sand and gravel mining, livestock grazing, agriculture, road construction, and rural and urban housing development, may occur in habitats that support the loggerhead shrike. The extent of these impacts, and the potential for them to affect this species, are not quantifiable.

Other cumulative effects to the loggerhead shrike, such as reduced habitat effectiveness, vehicle collision, individual mortality, and habitat fragmentation, would occur but are not quantifiable. The level of these effects on public and tribal lands is primarily related to oil and gas development and road use; on private lands, residential development is also a major factor. For this reason, a trend similar to the effects examined for habitat is expected. Specific mitigation measures are mentioned in the EIS that apply to sensitive species and are listed in Section 2.3.2, Project Design Recommendations, of this BE. The following specific mitigation measures apply to the loggerhead shrike:

- Minimize the number and length of new access roads.
- Construct access roads to new wells as spurs from the existing road system rather than as separate primary access roads where possible.
- Prohibit employees and contractors from bringing dogs or carrying firearms on site.
- Conduct periodic employee and contractor wildlife awareness programs that cover seasonal wildlife requirements and sensitivities, how disturbances affect wildlife, and ways personnel can reduce disturbances.

- Implement a travel management plan on NFS lands that shifts roads currently designated as open to motorized use to a closed designation to help reduce adverse indirect impacts from disturbance.
- Implement effective road closures (to public, motorized uses) to the extent possible on newly developed road systems.
- Remove all contaminants from project sites to avoid exposure to wildlife.
- Fence or cover emergency pits that are connected to each disposal well to prevent animals from drinking any contaminated water.
- Install mufflers or screens on exhaust systems to the extent possible to avoid wildlife entrapment and mortality.
- Minimize disturbance by clearing and otherwise disturbing only vegetation within the minimum area needed for safe and efficient development, production, and maintenance. Extra efforts should be used to avoid disturbance of stands of old-growth ponderosa pine.
- Protect and retain snags and down-dead logs to the extent possible. All snags and logs may be removed from areas of active construction and ground disturbance. Snags and logs outside of disturbance areas should be removed only when they pose a hazard to human life and property.
- Locate well pads, compressors, and other non-linear facilities outside of riparian areas, wetlands, and floodplains to protect the biological and hydrologic features.

Determination

Implementation of any of the alternatives, as described above, **may adversely impact individuals, but is not likely to result in a loss of viability on the planning area, nor cause a trend towards federal listing or a loss of species viability range wide** for the loggerhead shrike. This determination is based on the assumption of limited winter occurrence of this species and the lack of site fidelity to winter foraging habitats.

Additional Recommendations or Mitigation Measures

A complete list of recommendations and mitigation measures is provided in the EIS. No other measures are suggested for this species.

3.2.20 Fox Sparrow

Species Information

Status

The fox sparrow is classified as a sensitive species by Region 2 of the FS. According to BBS trend data, the population on a continental scale is considered stable (Colorado Bird Observatory 1997).

Distribution

The fox sparrow is widely distributed throughout Alaska, Canada, and as far south as southern California. The fox sparrow is considered fairly common in willow riparian habitats on the SJNF (especially within spruce-fir forests). During 1995, 1996, and 1997 breeding surveys for southwestern willow flycatchers, the fox sparrow was present in every willow patch surveyed on the Mancos-Dolores District; however, no nest searches were conducted for the fox sparrow, nor was there an attempt to count individuals. As such, no information on the density of population in the forest is available. This species may inhabit the upper

elevations of the Project Area, although probably in low numbers based on the small amount of habitats available within its documented elevation range. In the Project Area, 4,382 acres of mixed conifer and riparian/wetland community types on NFS lands may be suitable for the fox sparrow (Table 4).

Life History

This sparrow breeds in riparian willow shrublands and wet, willow-grown meadows, generally between 7,500 and 11,000 feet in elevation. In migration and during winter, it occurs in wooded riparian areas, as well as upland habitats (Andrews and Righter 1992). Its nesting requirements are nonspecific, needing only dense shrubby undergrowth (DeGraaf et al. 1991). Nests are usually in shrubs near the ground (less than 6 feet high), but may be on the ground or as much as 20 feet up in the canopy. Feeding occurs on the ground and consists primarily of seeds, but insects also are consumed (DeGraaf et al. 1991, Terres 1991). No reference to territory size was found, but it is assumed to be a few acres, similar to other sparrows.

Factors of Concern

Any impact to shrub-dominated riparian areas is of concern because of the potential degradation of nesting and foraging habitats.

Environmental Baseline

No CBM-related impacts to this species have been documented. There is the potential for undocumented impacts to have occurred to this species from existing CBM development; however, no data exist to show that undocumented impacts have occurred.

No other impacts to this species have been documented; however, it is likely that this species has been affected in the past by human presence and disturbance to suitable habitats within the Project Area.

Effects of the Alternatives

Alternatives 1, 1A, 1B, 2, and 3 propose the same number and type of wells and facilities near known occurrences of this species. Alternatives 4 and 5 involve construction of fewer wells and facilities near known occurrences. The types of effects to this species are the same among the alternatives and vary only according to the amount of habitat disturbed by each alternative. In general, alternatives that involve more wells and facilities (for example, Alternative 2) are more likely to affect this species and its habitats than are alternatives with fewer wells and facilities (for example, Alternative 5). Table 5 summarizes the amount of disturbance by alternative to habitats for the fox sparrow. Alternative 2 would disturb 2 percent (84 acres) of the habitats in the Project Area, the most by any alternative. Alternative 1 would disturb 1 percent and Alternatives 1A, 1B, 3, 4, and 5 would each disturb less that 1 percent of the habitats on NFS lands (Table 5).

Potential impacts to the fox sparrow caused by implementation of any of the alternatives include injury or mortality, disturbance or displacement of individuals, and degradation or destruction of habitats. Under certain conditions, road or utility corridors may cross wetland habitats. Construction activities associated with these efforts may degrade or destroy fox sparrow habitats. Injury to or mortality of eggs or young may occur as the result of construction within nesting habitats. Project activities may disturb or displace adults from nesting and foraging habitats, but no injury or mortality to adults is expected because of their ability to avoid human activity. These effects would be limited and are not expected to substantially affect the availability or suitability of fox sparrow habitats. Mitigation measures and BMPs would be used to minimize impacts to wetland and riparian habitats.

Within the cumulative effects analysis area, there are 13,403 acres of grassland, sagebrush, pinyon-juniper, and barren habitats for the fox sparrow. Depending on alternative, between 498 and 584 acres of these habitats would be cumulatively disturbed by past oil and gas development, the alternatives to the proposed project, and the selected alternative for the SUIT EIS. The cumulative disturbance to these habitats accounts for 3.7 to 4.4 percent of the available habitats in the cumulative effects analysis area. Although it is unlikely that most of these habitats support the fox sparrow, this analysis indicates the extent of potential cumulative effects to this species and its habitats. Activities on private lands, such as sand and gravel mining, livestock grazing, agriculture, road construction, and rural and urban housing development, may occur in habitats that support the fox sparrow. The extent of these impacts, and the potential for them to affect this species, are not quantifiable.

Other cumulative effects to the fox sparrow, such as reduced habitat effectiveness, vehicle collision, individual mortality, and habitat fragmentation, would occur but are not quantifiable. The level of these effects on public and tribal lands is primarily related to oil and gas development and road use; on private lands, residential development is also a major factor. For this reason, a trend similar to those examined for habitat is expected for these effects. Mitigation measures designed to avoid effects to the fox sparrow from all project activities would be implemented and would minimize the potential for any cumulative effects to this species. Specific mitigation measures are described in the EIS that apply to sensitive species and are listed in Section 2.3.2, Project Design Recommendations, of this BE. The following specific mitigation measures apply to the fox sparrow:

- Minimize the number and length of new access roads.
- Construct access roads to new wells as spurs from the existing road system rather than as separate primary access roads where possible.
- Prohibit employees and contractors from bringing dogs or carrying firearms on site.
- Conduct periodic employee and contractor wildlife awareness programs that cover seasonal wildlife requirements and sensitivities, how disturbances affect wildlife, and ways personnel can reduce disturbances.
- Implement a travel management plan on NFS lands that shifts roads currently designated as open to motorized use to a closed designation to help reduce adverse indirect impacts from disturbance.
- Implement effective road closures (to public, motorized uses) to the extent possible on newly developed road systems.
- Remove all contaminants from project sites to avoid exposure to wildlife.
- Fence or cover emergency pits that are connected to each disposal well to prevent animals from drinking any contaminated water.
- Install mufflers or screens on exhaust systems to the extent possible to avoid wildlife entrapment and mortality.
- Minimize disturbance by clearing and otherwise disturbing only vegetation within the minimum area needed for safe and efficient development, production, and maintenance. Extra efforts should be used to avoid disturbance of stands of old-growth ponderosa pine.
- Protect and retain snags and down-dead logs to the extent possible. All snags and logs may be removed from areas of active construction and ground disturbance. Snags and logs outside of disturbance areas should be removed only when they pose a hazard to human life and property.
- Locate well pads, compressors, and other non-linear facilities outside of riparian areas, wetlands, and floodplains to protect the biological and hydrologic features.

Determination

Implementation of any of the alternatives, as described above, **may adversely impact individuals, but is not likely to result in a loss of viability on the planning area, nor cause a trend towards federal listing or a loss of species viability range wide** for the fox sparrow. This determination is based on the potential for injury or mortality to individuals and the low likelihood these impacts would alter population health or warrant a change in protective status for this species.

Additional Recommendations or Mitigation Measures

A complete list of recommendations and mitigation measures is provided in the EIS. No other measures are suggested for this species.

3.2.21 Tiger Salamander

Species Information

Status

The tiger salamander is classified as a sensitive species by Region 2 of the FS.

Distribution

The tiger salamander ranges throughout much of North America. It occurs throughout Colorado at elevations up to 12,000 feet in all but tundra and alpine habitats (Hammerson 1999). This salamander has been found in numerous locations across the SJNF and is considered fairly common. This species is expected to occur in suitable habitats in the Project Area. Within the Project Area, 28 acres of riparian/wetland and water community types on NFS lands may be suitable for the tiger salamander (Table 4).

Life History

Tiger salamanders occur in virtually any habitat, provided there is a body of non-flowing water nearby for breeding. They inhabit ponds, lakes, and reservoirs ranging in size from 10 feet across to several acres. They will survive in a variety of water conditions ranging from clear, glacial water bodies to turbid stock ponds badly polluted with cow manure (Hammerson 1999). Sunny, mud-bottomed ponds at least 18 to 24 inches deep with a shallow beach-like shore seem to be preferred. Vegetation may or may not be present. However, tiger salamanders are typically absent from waters inhabited by predatory fish, bullfrogs, turtles, and crayfish. Metamorphosed salamanders usually spend their winter underground in rodent burrows. They will occasionally dig their own burrows in loose soil but are less likely to over-winter in these shallower burrows.

In water, metamorphosed salamanders eat snails, bugs, beetles, larval mayflies, dragonflies, caddis flies, and midges. In their adult terrestrial form, they are adapted to terrestrial predation, feeding on earthworms, insects, small mammals, and amphibians (Whiteman et al. 1994).

Factors of Concern

Any activities that occur in or adjacent to breeding sites that increase water temperatures or increased sediment loads and reduce in-stream coarse woody debris can degrade their habitat (Corn and Bury 1989). The latter two conditions can have long-term implications on salamanders. In addition, soil compaction adjacent to breeding sites could affect rodent burrows, where salamanders tend to over-winter.

Environmental Baseline

No CBM-related impacts to this species have been documented. There is the potential for undocumented impacts to have occurred to this species from existing CBM development; however, no data exist to show that undocumented impacts have occurred.

No other impacts to this species have been documented; however, it is likely that this species has been affected in the past by human presence and disturbance to suitable habitats within the Project Area.

Effects of the Alternatives

The types of effects to this species are the same among the different alternatives and vary only according to the amount of disturbed habitats estimated for each alternative. Table 5 summarizes the amount of disturbance by alternative to habitats for the tiger salamander. Impacts to tiger salamander habitats are not predicted for any of the alternatives; however, some project roads or pipeline corridors may cross habitats for the salamander. In the case of pipelines, the loss of habitat would be short term because the surface would be restored after construction. In the case of roads, small areas would be lost for the life of the project and potentially into the future for roads that become permanent and are not reclaimed. The extent of these impacts cannot be quantified, but is expected to be minimal, only a few acres across the entire Project Area for the life of the project.

During construction, disturbance to habitats may cause injury or mortality to individual salamanders that cannot escape. This impact would be minimal because of the small area of potential disturbance of habitats for the salamander.

Alteration of surface water and groundwater flows may also affect wetland and riparian habitats. As discussed in Section 3.6 of the EIS (Surface Water Resources), CBM development associated with the proposed action would cause additional depletions of groundwater. Depletions would occur because of dewatering of the Fruitland Formation during CBM production. A maximum of 200 acre-feet per year of water that currently enters the Animas, Pine, Florida, and Piedra Rivers would be depleted by the proposed action over the next 30 to 50 years. These depletions would not be measurable when compared with the base flows in these rivers, which are several orders of magnitude larger. These depletions are not likely to have any effect on aquatic habitats within or downstream of the Project Area. Construction of facilities under the proposed action would require 156 acre-feet of water over the life of the project. This water would be purchased from current users with existing water rights and would not cause new depletions from surface waters in the Project Area.

Mitigation measures would minimize impacts to riparian and wetland habitats that support tiger salamanders. In addition, U.S. Army Corps of Engineers regulations require that impacts to wetlands and floodplains be minimized, which would also limit impacts to tiger salamanders and their habitats.

Within the cumulative effects analysis area, there are 9,013 acres of riparian/wetland habitats for the tiger salamander. The cumulative effects resulting from the combination of past oil and gas development, the alternatives to the proposed project, and the alternatives selected for the SUIT EIS would disturb 496 acres of tiger salamander habitats. The cumulative disturbance to these habitats accounts for 5.5 percent of this vegetation type in the cumulative effects analysis area. Although it is unlikely that most of these habitats support the tiger salamander, this analysis indicates the extent of cumulative effects to this species and its habitats.

Past, present, and future projects would affect surface water and groundwater. In addition to the 200 acre-feet per year depletion predicted for this project, activities under the alternative selected for the SUIT EIS

would deplete an additional 66 acre-feet per year within the cumulative effects analysis area. Cumulatively, these depletions are unlikely to affect aquatic and riparian habitats that support the tiger salamander because base flows in streams in the cumulative effects analysis area are several orders of magnitude larger.

Activities on private lands, such as sand and gravel mining, livestock grazing, agriculture, road construction, and rural and urban housing development, may occur in habitats that support the tiger salamander. The extent of these impacts, and the potential for them to affect this species, are not quantifiable. Mitigation measures would be implemented to minimize cumulative effects to tiger salamander habitats (wetlands and riparian areas) from project activities. Specific mitigation measures are described in the EIS that apply to sensitive species and are listed in Section 2.3.2, Project Design Recommendations, of this BE. The following specific mitigation measures apply to the tiger salamander:

- Minimize the number and length of new access roads.
- Construct access roads to new wells as spurs from the existing road system rather than as separate primary access roads where possible.
- Prohibit employees and contractors from bringing dogs or carrying firearms on site.
- Conduct periodic employee and contractor wildlife awareness programs that covers seasonal wildlife requirements and sensitivities, how disturbances affect wildlife, and ways personnel can reduce disturbances.
- Implement a travel management plan on NFS lands that shifts roads currently designated as open to motorized use to a closed designation to help reduce adverse indirect impacts from disturbance.
- Implement effective road closures (to public, motorized uses) to the extent possible on newly developed road systems.
- Remove all contaminants from project sites to avoid exposure to wildlife.
- Fence or cover emergency pits that are connected to each disposal well to prevent animals from drinking any contaminated water.
- Install mufflers or screens on exhaust systems to the extent possible to avoid wildlife entrapment and mortality.
- Minimize disturbance by clearing and otherwise disturbing only vegetation within the minimum area needed for safe and efficient development, production, and maintenance. Extra efforts should be used to avoid disturbance of stands of old-growth ponderosa pine.
- Protect and retain snags and down-dead logs to the extent possible. All snags and logs may be removed from areas of active construction and ground disturbance. Snags and logs outside of disturbance areas should be removed only when they pose a hazard to human life and property.
- Locate well pads, compressors, and other non-linear facilities outside of riparian areas, wetlands, and floodplains to protect the biological and hydrologic features.

Determination

Implementation of any of the alternatives, as described above, **may adversely impact individuals, but is not likely to result in a loss of viability on the planning area, nor cause a trend towards federal listing or a loss of species viability range wide** for the tiger salamander. This determination is based on the minimal potential for effects to tiger salamanders and their habitats and on the implementation of mitigation measures intended to minimize effects to wetland and riparian habitats.

Additional Recommendations or Mitigation Measures

A complete list of recommendations and mitigation measures is provided in the EIS. No other measures are suggested for this species.

3.2.22 Northern Leopard Frog

Species Information

Status

The leopard frog is classified as a sensitive species by Region 2 of the FS and the BLM in the State of Colorado. It is considered a species of special concern by the State of Colorado.

Distribution

The leopard frog is found throughout northern North America and southern Canada, except on the West Coast (Behler and King 1979). It is found throughout Colorado except in the southeastern portion of the state, south of the Arkansas River. The presence of this species has been documented on the Mancos-Dolores and Pagosa Ranger Districts. It is expected to occur in suitable habitats in the Project Area. Within the Project Area, 28 acres of riparian/wetland and water community types on NFS lands may be suitable for the northern leopard frog (Table 4).

Life History

According to Hammerson (1999), the northern leopard frog prefers the banks and shallows of marshes, ponds, lakes, reservoirs, beaver ponds, streams, and other permanent bodies of water, especially with rooted vegetation. Wetland and riparian areas play an essential role throughout the year. Once breeding is complete, leopard frogs inhabit grassy meadows within a jump or two of escape into water (Gilbert et al. 1994, Merrill 1977). Adults are highly mobile, moving at night or when vegetation is wet. Roads can be readily crossed, but road kills can be substantial during mass migration.

Pond habitats associated with beaver complexes appear to be the preferred habitat for leopard frogs on the SJNF, based on casual observation. Beaver complexes afford the slow-moving backwaters this species favors. Leopard frogs over-winter submerged in lakes, ponds, wetlands, and streams (Cunjak 1986, Merrill 1977). Winter sites must not freeze completely; therefore, shallow ponds or streams may be un-suitable (Merrill 1977).

Factors of Concern

Any affect to the natural hydrological flow could negatively affect potential habitat for northern leopard frogs. Heavy grazing in and adjacent to the riparian and wetland areas could affect the overall quality of the habitat by reducing hiding and foraging cover. Traffic on roads near suitable habitat can cause direct mortality of individuals.

Environmental Baseline

No CBM-related impacts to this species have been documented. There is the potential for undocumented impacts to have occurred to this species from existing CBM development; however, no data exist to show that undocumented impacts have occurred.

No other impacts to this species have been documented; however, it is likely that this species has been affected in the past by human presence and disturbance to suitable habitats within the Project Area.

Effects of the Alternatives

The types of effects to this species are the same among the alternatives and vary only according to the amount of disturbed habitats estimated for each alternative. Table 5 summarizes the amount of disturbance by alternative to habitats for the northern leopard frog. Impacts to habitats for the northern leopard frog are not predicted for any of the alternatives; however, some project roads or pipeline corridors may cross these habitats. In the case of pipelines, the loss of habitat would be short term because the surface would be restored after construction. In the case of roads, small areas would be lost for the life of the project and potentially into the future for roads that become permanent and are not reclaimed. The extent of these impacts cannot be quantified, but is expected to be minimal, about a few acres across the entire Project Area over the life of the project.

During construction, disturbance to habitats may cause injury or mortality to individual frogs that cannot escape. This impact would be minimal because of the small area of potential disturbance of frog habitats.

Alteration of surface water and groundwater flows may also affect wetland and riparian habitats. As discussed in Section 3.6 of the EIS (Surface Water Resources), CBM development associated with the proposed action would cause additional depletions of groundwater. Depletions would occur because of dewatering of the Fruitland Formation during CBM production. A maximum of 200 acre-feet per year of water that currently enters the Animas, Pine, Florida, and Piedra Rivers would be depleted by the proposed action over the next 30 to 50 years. These depletions would not be measurable when compared with the base flows in these rivers, which are several orders of magnitude larger. These depletions are not likely to have any effect on aquatic habitats within or downstream of the Project Area. Construction of facilities under the proposed action would require 156 acre-feet of water over the life of the project. This water would be purchased from current users with existing water rights and would not cause new depletions from surface waters in the Project Area.

Mitigation measures would minimize impacts to riparian and wetland habitats that support northern leopard frogs. In addition, U.S. Army Corps of Engineers regulations require that impacts to wetlands and floodplains be minimized, which would also limit impacts to northern leopard frog and their habitats.

Within the cumulative effects analysis area, there are 9,013 acres of riparian and wetland habitats for the northern leopard frog. The cumulative effects resulting from the combination of past oil and gas development, the alternatives to the proposed project, and the alternative selected for the SUIT EIS would disturb 496 acres of northern leopard frog habitats. The cumulative disturbance to these habitats accounts for 5.5 percent of this vegetation type in the cumulative effects analysis area. Although it is unlikely that most of these habitats support the northern leopard frog, this analysis indicates the extent of cumulative effects to this species and its habitats.

Past, present, and future projects would affect surface water and groundwater. In addition to the 200 acre-feet per year depletion predicted for this project, activities under the alternative selected for the SUIT EIS would deplete an additional 66 acre-feet per year within the cumulative effects analysis area. Cumulatively, these depletions are unlikely to affect aquatic and riparian habitats that support the northern leopard frog because base flows in streams in the cumulative effects analysis area are several orders of magnitude larger.

Activities on private lands, such as sand and gravel mining, livestock grazing, agriculture, road construction, and rural and urban housing development, may occur in habitats that support the northern leopard frog. The extent of these impacts, and the potential for them to affect this species, are not quantifiable. Mitigation measures would be implemented to minimize cumulative effects to habitats for the northern leopard frog (wetlands and riparian areas) from project activities. Specific mitigation measures are de-

scribed in the EIS that apply to sensitive species and are listed in Section 2.3.2, Project Design Recommendations, of this BE. The following specific mitigation measures apply to the northern leopard frog:

- Minimize the number and length of new access roads.
- Construct access roads to new wells as spurs from the existing road system rather than as separate primary access roads where possible.
- Prohibit employees and contractors from bringing dogs or carrying firearms on site.
- Conduct periodic employee and contractor wildlife awareness programs that cover seasonal wildlife requirements and sensitivities, how disturbances affect wildlife, and ways personnel can reduce disturbances.
- Implement a travel management plan on NFS lands that shifts roads that designated as open to motorized use to a closed designation to help reduce adverse indirect impacts from disturbance.
- Implement effective road closures (to public, motorized uses) to the extent possible on newly developed road systems.
- Remove all contaminants from project sites to avoid exposure to wildlife.
- Fence or cover emergency pits that are connected to each disposal well to prevent animals from drinking any contaminated water.
- Install mufflers or screens on exhaust systems to the extent possible to avoid wildlife entrapment and mortality.
- Minimize disturbance by clearing and otherwise disturbing only vegetation within the minimum area needed for safe and efficient development, production, and maintenance. Extra efforts should be used to avoid disturbance of stands of old-growth ponderosa pine.
- Protect and retain snags and down-dead logs to the extent possible. All snags and logs may be removed from areas of active construction and ground disturbance. Snags and logs outside of disturbance areas should be removed only when they pose a hazard to human life and property.
- Locate well pads, compressors, and other non-linear facilities outside of riparian areas, wetlands, and floodplains to protect the biological and hydrologic features.

Determination

Implementation of any of the alternatives, as described above, **may adversely impact individuals, but is not likely to result in a loss of viability on the planning area, nor cause a trend towards federal listing or a loss of species viability range wide** for the northern leopard frog. This determination is based on the minimal potential for effects to northern leopard frogs and their habitats and on the implementation of mitigation measures intended to minimize effects to wetland and riparian habitats.

Additional Recommendations or Mitigation Measures

A complete list of recommendations and mitigation measures is provided in the EIS. No other measures are suggested for this species.

3.2.23 Milk Snake

Species Information

Status

The milk snake is classified as a sensitive species by Region 2 of the FS and the BLM in the State of Colorado.

Distribution

The distribution of the milk snake may be the widest of any living snake species, ranging from extreme southern Canada to northern South America (Hammerson 1999). In southern Colorado, it has been found at elevations below 8,000 feet in Conejos, Archuleta, La Plata, and Montezuma Counties (Hammerson 1999). There have been no inventories on the SJNF for this species, however. In addition, sightings of the milk snake in the general vicinity are rare. This species is known to occur near and may occur in suitable habitats in the Project Area. Within the Project Area, 43,762 acres of grassland, sagebrush, pinyon-juniper, mountain shrub, Gambel oak, ponderosa pine, and barren community types on NFS lands may be suitable for the milk snake (Table 4).

Life History

The milk snake occurs in a wide variety of habitats in Colorado, including grasslands, sandhills, canyons, rocky hillsides, open stands of ponderosa pine, pinyon-juniper woodland, and arid river valleys (Hammerson 1999, Stebbins 1985). It is commonly found inside rotten logs and stumps, and under rocks, logs, bark, and boards (Stebbins 1985). Milk snakes emerge from their subterranean winter retreats in the spring and remain active until September or October. Eggs are laid during mid-summer, and young snakes appear in August and September. This snake is a constrictor and eats a variety of small vertebrates, including small mammals, birds, lizards, snakes, and bird and reptile eggs (Hammerson 1999).

Factors of Concern

Any activity that would reduce hiding cover, such as rotten logs, could reduce the suitability of habitats for milk snakes. Mortality could occur to individuals on roadways near suitable habitats.

Environmental Baseline

No CBM-related impacts to this species have been documented. There is the potential for undocumented impacts to have occurred to this species from existing CBM development; however, no data exist to show that undocumented impacts have occurred.

No other impacts to this species have been documented; however, it is likely that this species has been affected in the past by human presence and disturbance to suitable habitats within the Project Area.

Effects of the Alternatives

Alternatives 1, 1A, 1B, 2, and 3 propose the same number and type of wells and facilities near known occurrences of this species. Alternatives 4 and 5 involve construction of fewer wells and facilities near known occurrences. The types of effects to this species are the same among the alternatives and vary only according to the amount of habitat disturbed by each alternative. In general, alternatives that involve more wells and facilities (for example, Alternative 2) are more likely to affect this species and its habitats than are alternatives with fewer wells and facilities (for example, Alternative 5). Table 5 summarizes the amount of disturbance by alternative to milk snake habitats. Alternative 2 would disturb 2 percent (1,048

acres) of the habitats in the Project Area, the most by any alternative. Alternatives 1 would disturb 1 percent and Alternatives 1A, 1B, 3, 4, and 5 would each disturb less than 1 percent of the habitats on NFS lands (Table 5).

Potential impacts to the milk snake caused by implementation of any of the alternatives may include injury to or mortality of individuals and degradation or destruction of habitats. Injury or mortality of individuals may result from trampling or crushing by heavy equipment or vehicle traffic. Construction of project facilities would result in a patchwork pattern of disturbance within a mosaic of habitats for the milk snake. Although undisturbed habitats exist in the Project Area, their carrying capacity and suitability to support displaced individuals are unknown. These habitats are assumed to occur within the Project Area, and milk snakes are expected to use these habitats without impacts to individual health or population status. Project implementation would not alter the occurrence or availability of prey species preferred by the milk snake.

Within the cumulative effects analysis area, there are 456,029 acres of grassland, sagebrush, pinyon-juniper, mountain shrub, Gambel oak, ponderosa pine, and barren habitats for the milk snake. Depending on alternative, between 22,534 and 23,791 acres of these habitats would be cumulatively disturbed by past oil and gas development, the alternatives to the proposed project, and the alternative selected for the SUIT EIS. The cumulative disturbance to these habitats accounts for 4.9 to 5.2 percent of the available habitats in the cumulative effects analysis area. Although it is unlikely that most of these habitats support the milk snake, this analysis indicates the extent of cumulative habitat loss. Activities on private lands, such as sand and gravel mining, livestock grazing, agriculture, road construction, and rural and urban housing development, would occur in habitats that may support the milk snake. The extent of these impacts, and the potential for them to affect this species, are not quantifiable.

Other cumulative effects to the milk snake, such as reduced habitat effectiveness, vehicle collision, individual mortality, and habitat fragmentation, would occur but are not quantifiable. The level of these effects on public and tribal lands is related primarily to oil and gas development and road use; on private lands, residential development is also a major factor. For this reason, a similar trend is expected for these effects as was shown for habitats. Specific mitigation measures are described in the EIS that apply to sensitive species and are listed in Section 2.3.2, Project Design Recommendations, of this BE. The following specific mitigation measures apply to the milk snake:

- Minimize the number and length of new access roads.
- Construct access roads to new wells as spurs from the existing road system rather than as separate primary access roads where possible.
- Prohibit employees and contractors from bringing dogs or carrying firearms on site.
- Conduct periodic employee and contractor wildlife awareness programs that cover seasonal wildlife requirements and sensitivities, how disturbances affect wildlife, and ways personnel can reduce disturbances.
- Implement a travel management plan on NFS lands that shifts roads currently designated as open to motorized use to a closed designation to help reduce adverse indirect impacts from disturbance.
- Implement effective road closures (to public, motorized uses) to the extent possible on newly developed road systems.
- Remove all contaminants from project sites to avoid exposure to wildlife.
- Fence or cover emergency pits that are connected to each disposal well to prevent animals from drinking any contaminated water.

- Install mufflers or screens on exhaust systems to the extent possible to avoid wildlife entrapment and mortality.
- Minimize disturbance by clearing and otherwise disturbing only vegetation within the minimum area needed for safe and efficient development, production, and maintenance. Extra efforts should be used to avoid disturbance of stands of old-growth ponderosa pine.
- Protect and retain snags and down-dead logs to the extent possible. All snags and logs may be removed from areas of active construction and ground disturbance. Snags and logs outside of disturbance areas should be removed only when they pose a hazard to human life and property.

Determination

Implementation of any of the alternatives, as described above, **may adversely impact individuals, but is not likely to result in a loss of viability on the planning area, nor cause a trend towards federal listing or a loss of species viability range wide** for the milk snake. This determination is based on the potential for injury or mortality to individuals and the low likelihood these impacts would alter population health or warrant a change in protective status for this species.

Additional Recommendations or Mitigation Measures

A complete list of recommendations and mitigation measures is provided in the EIS. No other measures are suggested for this species.

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Schultz pers. comm. Chris Schultz is a biologist on the SJNF.

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Appendix J
Management Indicator Species Analyses

APPENDIX J

MANAGEMENT INDICATOR SPECIES ANALYSES

NORTHERN SAN JUAN BASIN COAL BED METHANE DEVELOPMENT ENVIRONMENTAL IMPACT STATEMENT

San Juan National Forest
Archuleta and La Plata Counties

Prepared by:

Anthony Garcia, District/Field Office Wildlife Biologist
Columbine Ranger District/Field Office

Chris Schultz, Wildlife Biologist
San Juan Public Lands Center

Dave Gerhardt, Fisheries Program Manager
San Juan Public Lands Center

Gary Vos, District/Field Office Wildlife Biologist
Pagosa Ranger District/Field Office

Kristen Philbrook, District/Field Office Wildlife Biologist
Dolores Ranger District/Field Office

Mark Ball, Wildlife Program Manager
San Juan Public Lands Center

Jim Powers, Project Manager
San Juan Public Lands Center

Matt Schweich, Senior Ecologist
Greystone Environmental Consultants, Inc.

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Appendix J — Management Indicator Species Analysis

One of the goals of managing National Forest lands is to provide for healthy ecosystems capable of sustaining a variety of wildlife species. These ecosystems often include many different habitat types capable of supporting numerous wildlife species. Due to the large number of species potentially occupying any given area, it would be impossible to evaluate the status of all species in an area over time. Therefore, Management Indicator Species (MIS) are selected to represent groups of species that have similar habitat needs or similar population characteristics, and whose population can be quantitatively ascertained. Species identified as MIS are selected because their population changes are believed to indicate the effects of management activities on wildlife populations as a whole (36 CFR 219.19(a)(1)).

Each National Forest is managed under a Land and Resource Management Plan (LRMP) that establishes management direction, including those for wildlife species and their habitats. The LMRP identifies MIS for the purpose of evaluating Forest Plan alternatives, and to assist in the ongoing evaluation of Plan implementation. The Plan contains management objectives, standards and guidelines, and monitoring requirements specific to MIS. These regulations and policies are applicable to all actions conducted on National Forest System lands, and are based in the laws, regulations and policies governing National Forest management.

The primary objective of any MIS assessment is to identify Forest-wide trends in population numbers Forest-wide trends in habitats that support these populations, and to identify any possible relationship between observed changes in habitat and changes in wildlife populations, as described in 36 CFR 219.19 (a) (6). Analysis of population and habitat status that presently exists at the project level can then be related to the large-scale trend analysis. This results in a better identification of cause and effect relationships, which in turn support alternative selection. The analysis may also help identify information needs and help focus Forest-level monitoring efforts.

There are situations where it is appropriate to use habitat trend alone as a surrogate for population trend. This occurs when it is well established in the scientific literature that the tie between habitat and species abundance is unusually strong and that population trends follow habitat trends. This approach is often applied when population data are unattainable or unreliable and habitat data provide a better picture of population trends.

Procedural aspects aside, the underlying purpose of the MIS analysis is to provide the decision maker(s) with the best information available in support of sound Forest management activities.

Although the concept of MIS may apply beyond National Forest System lands, the regulatory requirement to conduct such assessments does not apply to actions occurring on U.S. Bureau of Land Management (BLM), state, or private lands.

J.1 Scales of Analysis and MIS Species Status

A variety of spatial scales may be applied to an MIS assessment. In evaluating species-habitat relationships, it is important to understand which spatial scales are appropriate for the question being asked. For example, population trends for wide-ranging species (e.g. elk) are best determined at a Forest-wide scale. Trend evaluations done at a local scale will not account for behavioral factors such as movement, and if taken alone can lead to erroneous conclusion about species mortality rates. It is also infeasible or impractical to collect what may be years of baseline information sufficient to determine population trends at a local scale. This would require that projects be identified in enough detail to structure such studies many years in advance of implementation. This approach is simply impractical, technically infeasible, and not cost effective.

Data collection and analysis at the project level may be very different than that collected for forest-wide assessment, since it is often collected with a different purpose in mind. If identifying specific factors that limit species abundance and distribution is desired, a Forest-wide approach may not be possible. Due to the number of variables involved and the inability to isolate and control the variables at a large scale, this question is best left to small-scale, scientific assessments where variables can be better controlled and treatments can be directly correlated with species response.

In some situations, local managers cannot determine cause and effect relationships with any level of confidence. Due to the limitations of applying the scientific method in ever-changing natural environments, it is often better to rely on the body of scientific literature to address the more complex questions. These studies are conducted by research scientists in controlled environments and can be much more reliable than local monitoring results. Where these studies are applied locally, efforts should concentrate on validating the applicability of their findings to local conditions, not trying to replicate the efforts using questionable methods and conditions.

Forest Service regulations and policies establish the need to evaluate trends of MIS populations and identify any relationship to changes in their habitats at the Forest-wide scale (36 CFR 219.19 (a)(6)). Because of the large scale being considered, the data used to identify these trends is often general and coarse in nature. In many cases, the results provide an initial "heads-up" look at how populations and habitats might be changing. This scale of assessment is not intended to identify the specific limiting factors that determine population structure. While it may be possible to acquire some relevant information about these factors, such attempts are often technically infeasible and not cost effective.

This MIS analysis addresses trends in species abundance and their associated habitats at the Forest-wide scale. It then relates what is known at the project level about species occurrence and habitat distribution in a manner that addresses project effects to overall Forest-wide trends.

The project-level analysis includes the entire Project Area and a larger cumulative effects area, including BLM, state, and private lands. Analyzing potential effects across the entire Project Area, and beyond, is appropriate because many wildlife species interchangeably use habitats across the four major land jurisdictions on a year-round or seasonal basis. The analysis of MIS impact across the entire Project Area should more adequately describe effects of proposed CBM development on wildlife, as opposed to evaluating SJNF lands alone.

The MIS species selected for this proposed action are well distributed across the national forest. The project area provides habitats which are also well distributed and connected to the larger national forest unit. The project area does not provide unique or isolated habitat which discrete populations are dependent. The MIS species selected for this project are not species at risk nor are they species that are trending towards protected status. Our concern is how this project may affect the broader Forest wide trends for these MIS species.

J.2 Selection of MIS for the Analysis

The Forest Plan states that, where present, deer, elk, and all federally listed threatened or endangered species are potential MIS (FS 1992). Other species are also identified as potential MIS in the Forest Plan. Table J–1 lists the current Forest Plan MIS and the reasons for their selection. Habitats for all potential MIS are also shown in Table J–1. This list is based in part on the most recent U.S. Fish and Wildlife Service (USFWS) threatened and endangered species list (USFWS 2002).

Several species listed in Table J–1 have been eliminated from further analysis. The reasons for their elimination are:

- Typically they are found in habitats that do not occur in the Project Area;
- They are not known to occur in the Project Area, because no habitat is present;
- They have not developed a functional population structure in the Project Area or on the SJNF;
- They have irregular patterns of habitat occupancy;
- Their needs are covered by other species that are already addressed in this analysis; or
- Their populations are influenced by other factors besides specific management activities; therefore, no important direct cause and effect relationship can be determined.
- Their populations cannot be cost effectively monitored and/or there are no effective monitoring protocols established through research and practical application.

Table J–2 lists all potential MIS, their habitat types, whether they were selected as MIS for the Northern San Juan Basin (NSJB) CBM Project, and the rationale for their selection or dismissal.

Table J–1 Potential Management Indicator Species Identified in the Forest Plan

MIS	Habitat Type(s)	Reason for Selection
Abert's squirrel	Ponderosa pine	Unique habitat that easily monitors change and limited range nationwide
American marten	Spruce-fir and cool-moist mixed conifer	Unique habitat that easily monitors change
Bald eagle	Mature forest associated with large bodies of water	Threatened specie
Beaver	Aquatic, riparian, and aspen	Unique habitat
Black bear	All forested types, grassland, riparian, Gambel oak, mountain shrub, aspen, and piñon-juniper	Economically important game species, represents large group of species
Black-footed ferret	Low-elevation grasslands and shrublands	Endangered specie
Bonytail	Aquatic	Endangered specie
Brook trout	Aquatic	Economically important
Brown trout	Aquatic	Economically important
Canada lynx	Mixed conifer, spruce-fir and aspen	Threatened specie
Colorado pikeminnow	Aquatic	Endangered specie
Colorado River cutthroat trout	Aquatic	Sensitive specie
Columbian sharp-tailed grouse	Mountain shrub	Limited habitat on the SJNF
Deer mouse	Early-successional habitats and mature open stands of aspen and warm-dry mixed conifer	Represents larger group of species
Elk	All terrestrial habitats; pine, piñon-juniper and mountain shrublands in winter	Economically important game specie, public issue
Green-tailed towhee	Gambel oak, mountain shrub, piñon-juniper, sagebrush, and riparian	Unique habitat; habitat that can be monitored
Hairy woodpecker	All forested types, aspen, and piñon-juniper	Unique habitat; habitat that can be monitored
Humpback chub	Aquatic	Endangered specie
Mallard	Aquatic and riparian	Economically important and wetland habitat indicator
Merriam's turkey	Grasslands, riparian, Gambel oak, mountain shrub, aspen, piñon-juniper, ponderosa pine, and mixed conifer	Economically important game species
Mexican spotted owl	Mature ponderosa pine and mixed conifer in canyons	Threatened specie
Mountain bluebird	Early-successional, mature alpine, aspen, mixed conifer, Gambel oak, mountain shrub, piñon-juniper, ponderosa pine, and sagebrush	Unique habitat that would monitor management practices
Mule deer	All terrestrial habitats; pine, piñon-juniper, and Gambel oak, mountain shrublands in winter	Economically important game species, public issue
Northern goshawk	Mature forest habitats	Environmentally sensitive
Rainbow trout	Aquatic	Economically important
Razorback sucker	Aquatic	Endangered specie
River otter	Aquatic and riparian	State endangered specie
Southwestern willow flycatcher	Riparian shrub	Endangered specie
Uncompahgre fritillary butterfly	Alpine with snow willow	Endangered specie

Table J–2 Management Indicator Species Selected and Dismissed from Analysis

MIS	Habitat Type	Selected for Analysis?	Rationale for Selection or Dismissal
Abert's squirrel	Ponderosa pine	Yes	Species and habitats are present in the Project Area. Strong relationship between the species and ponderosa pine habitat. Species population trend can be inferred by monitoring and evaluating species-habitat relationships.
American marten	Spruce-fir and cool-moist mixed conifer	No	The species is not known to occur in the Project Area. Minimal habitat is present.
Bald eagle	Mature forest associated with large bodies of water	No	Species is primarily a fall and winter migrant to the area. There are likely other activities outside the Project Area that influence bald eagle populations. There is also limited habitat in the form of large lakes and reservoirs in Project Area. The species is addressed in the Biological Assessment.
Beaver	Aquatic, riparian, and aspen	No	The brown trout is used as the MIS for species inhabiting streams and rivers in the Project Area.
Black bear	All forested types, grassland, riparian, Gambel oak, mountain shrub, aspen, and piñon-juniper	No	Species and habitats are present in the Project Area. Populations cannot be effectively monitored. Bear overlap with other species that are more readily monitored. Elk, deer, and green tailed towhee were chosen to measure project effects for habitat representations shared by bear. The species is evaluated in the game species section of Chapter 3 in response to scoping.
Black-footed ferret	Low elevation grasslands and shrublands	No	The species does not occur in the Project Area. Minimal habitat is present.
Bonytail	Aquatic	No	The species does not occur in the Project Area, nor is it influenced by water depletions from the San Juan Basin.
Brook trout	Aquatic	No	The brown trout is used as the MIS for species inhabiting streams and rivers in the Project Area.
Brown trout	Aquatic	Yes	Species is known to occur in the Pine, Florida, and San Juan Rivers in the Project Area. It is more common in the Project Area than other aquatic MIS.
Canada lynx	Mixed conifer, spruce-fir, and aspen	No	The species is not known to occur in the Project Area. Minimal habitat is present. None of the area is within a Lynx Analysis Unit.
Colorado pikeminnow	Aquatic	No	Species does not occur in the Project Area. The species is influenced by water depletions occurring from the San Juan Basin. The species is addressed in the Biological Assessment.
Colorado River cutthroat trout	Aquatic	No	Species does not occur in the Project Area.
Columbian sharp-tailed grouse	Mountain shrublands	No	Species does not occur in the Project Area.
Deer mouse	Early-successional habitats, mature, open stands of aspen, and warm-dry mixed conifer	No	Many factors influence deer mice populations. Populations can vary from month to month and year to year, because of factors such as food availability and weather, as opposed to specific human actions. Consequently, population levels fluctuate greatly and are not good indicators of the effects of management activities.
Elk	All terrestrial habitats; pine, piñon-juniper, Gambel oak, and mountain shrub in winter	Yes	Species and habitats are present in the Project Area. Project Area provides key big-game winter range.
Green-tailed towhee	Gambel oak, mountain shrub, piñon-juniper, sagebrush, and riparian	Yes	Species and habitats are present in the Project Area. The species is closely associated with Gambel oak and mountain shrub communities.
Hairy woodpecker	All forested types, aspen, and piñon-juniper	Yes	Species and habitats are present in the Project Area. The species is closely associated with mature and late successional forests that contain key habitat components such as snags that are required for nesting.
Humpback chub	Aquatic	No	Species does not occur in the Project Area, nor is it influenced by water depletions from the San Juan Basin.

Table J–2 Management Indicator Species Selected and Dismissed from Analysis

MIS	Habitat Type	Selected for Analysis?	Rationale for Selection or Dismissal
Mallard	Aquatic and riparian.	No	Wetlands inhabited by mallards would be avoided by project activities. Indirect effects are not expected to wetlands to the extent that mallards would be affected. There does not appear to be a clear cause-and-effect relationship between the proposed project and mallard populations.
Merriam's turkey	Grasslands, riparian, Gambel oak, mountain shrub, aspen, piñon-juniper, ponderosa pine, and mixed conifer	No	Species and habitats are present in the Project Area. Turkey populations are influenced by other controlling factors besides project specific management activities, particularly weather severity, predation, and hunting. Therefore, no important direct cause and effect relationship with this project besides potential minor impact to roost tree habitat can be determined. The species is addressed in the game species section of Chapter 3 in response to public scoping.
Mexican spotted owl	Mature ponderosa pine and mixed conifer in canyons	No	Species is not known to occur in the Project Area. There are minimal canyon-like habitats present in the Project Area. The species is addressed in the Biological Assessment.
Mountain bluebird	Early-successional, mature alpine, aspen, mixed conifer, Gambel oak, mountain shrub, piñon-juniper, ponderosa pine, and sagebrush	Yes	Species and habitats are present in the Project Area. The species is highly associated with snags along, or within close proximity to, early successional habitats such as open grasslands and parks.
Mule deer	All terrestrial habitats; pine, piñon-juniper, Gambel oak, and mountain shrub in winter	Yes	Species and habitats are present in the Project Area. Project Area provides key big-game winter range.
Northern goshawk	Mature forest habitats	No	Species and habitats are present in the Project Area. Mitigation prescribed by Forest Plan standards and guidelines will be applied to all alternatives to mitigate management effects to goshawk. Therefore, goshawk effects are expected to be similar for all alternatives and do not reflect management. Goshawk is a FS Sensitive species evaluated in the Biological Evaluation.
Rainbow trout	Aquatic	No	The brown trout is used as the MIS for species inhabiting streams and rivers in the Project Area. Population levels are likely more influenced by stocking efforts conducted by the Colorado Division of Wildlife.
Razorback sucker	Aquatic	No	Species does not occur in the Project Area. The species is influenced by water depletions occurring from the San Juan Basin. The species is addressed in the Biological Assessment.
River otter	Aquatic and riparian	No	The brown trout is used as the MIS for species inhabiting streams and rivers in the Project Area.
Southwestern willow flycatcher	Riparian shrub	No	Current population levels of the species are unknown in the Project Area. There are minimal habitats present in the Project Area. Mitigation measures would result in avoidance of effects on habitats. The species is addressed in the Biological Assessment.
Uncompahgre fritillary butterfly	Alpine with snow willow	No	Species does not occur in the Project Area. There are no habitats present in the Project Area.

J.3 Project Design

This section describes the basic design of the proposed project and alternatives, including any project design features and mitigation measures that would influence the effects of the project on MIS.

J.3.1 Project and Alternative Summary

The proposed project and alternatives are described in detail in Chapter 2 of the EIS. Table J–3 summarizes the number of wells, disposal wells, and compressors, as well as the length of roads and pipelines, for each of the alternatives.

Table J–3 Summary of Project Facilities by Alternative

Facility/ Land Ownership	Proposed Facilities, by Alternative						
	1	1A	1B	2	3	4	5
Well Pads							
BLM Lands	12	12	12	22	12	12	0
NFS Lands	162	100	50	272	101	73	15
State Lands	7	7	5	15	7	7	7
Private Lands	92	92	91	190	92	93	95
Total	273	211	158	499	212	185	117
Roads/Pipelines (total length in miles)							
BLM Lands	3	3	3	6	3	3	0
NFS Lands	96	73	38	151	52	64	15
State Lands	7	1	0	3	2	1	1
Private Lands	22	22	21	47	22	23	24
Undetermined Location	17	17	17	17	10	10	10
Total	145	116	79	224	89	101	50
Disposal Well Sites							
BLM Lands	0	0	0	0	0	0	0
NFS Lands	1	0	1	1	0	0	0
State Lands	0	0	0	0	0	0	0
Private Lands	0	0	0	0	0	0	0
Outside Project Area	2	2	2	2	2	2	0
Undetermined Location	4	4	4	4	2	0	0
Total	7	6	7	7	4	2	0
Compressor Sites							
BLM Lands	0	0	0	0	0	0	0
NFS Lands	9	9	3	10	5	3	0
State Lands	2	2	2	2	2	1	2
Private Lands	2	2	2	2	2	1	2
Outside Project Area	1	1	0	1	1	1	1
Undetermined Location	0	0	0	0	0	0	0
Total	14	14	7	15	10	6	5
Automated Central Gathering Stations							
BLM Lands	0	0	0	0	0	0	0
NFS Lands	0	0	4	0	0	0	0
State Lands	0	0	0	0	0	0	0
Private Lands	0	0	0	0	0	0	0
Total	0	0	4	0	0	0	0

J.3.2 Project Design Features

Several design features apply to the proposed project. Some apply to all alternatives, while others apply only to specific alternatives, as explained below. These design features include:

- Directional well drilling is employed in Alternatives 1, 1A, 1B, and 2, and horizontal well drilling in Alternatives 1A and 1B; therefore, the number of well pads shown in Table J–3 is less than the total number of wells. Alterna-

tive 1, for example, would have 296 wells on 273 pads; Alternative 2, 522 wells on 499 well pads.

- Travel-management policy would be implemented on NFS land that eliminates off-road motorized travel and restricts ATV use to designated routes to reduce adverse, effects of human disturbance. This change in travel management would be employed in Alternatives 1 through 3.

- Well construction would begin in 2005 and continue for 5 years. The productive life of wells would be 25 to 30 years. Final reclamation would occur over 2 to 3 years after production ceases. The project would be completed by 2040.

- There would be no surface discharge of produced water; all produced water would be injected into disposal wells.

- Water needed for roads, compressor stations, and well drilling would be purchased from local sources.

- All in-use areas of roads, well pads, and compressor stations would be graveled.

- Interim reclamation would occur on all parts of roads and well pads not needed for production activities.

- Final reclamation would attempt to replace the vegetation type that was removed during construction.

J.3.3 Mitigation Measures Common to All Alternatives

In addition to Forest Plan standards and guidelines, the following mitigation measures are included in all alternatives to reduce or minimize effects of CBM development and production on wildlife and their habitats:

- Minimize the number and length of new access roads. This measure reduces direct habitat loss and loss of habitat effectiveness.

- Where possible, construct access roads to new wells as spurs from the existing road system rather than as separate primary access roads. This measure reduces direct habitat loss and loss of habitat effectiveness.

- Prohibit employees and contractors from bringing dogs or carrying firearms on site. This mitigation reinforces standard working agreements with industry.

- Continue to implement periodic employee and contractor wildlife-awareness programs, covering seasonal wildlife requirements and sensitivities, how disturbances affect wildlife, and ways personnel can reduce disturbances. Ex-

perience has shown that these forums promote effective industry participation in implementing and enforcing mitigation measures.

- Install mufflers or screens on exhaust systems, to avoid wildlife entrapment and mortality.

- Avoid construction within riparian and wooded riparian areas. This measure reduces critical habitat loss and potential for stream sedimentation.

- Inventory for and restrict new well locations and rights-of-way to at least 1/4 mile from a raptor nest or winter roost. This measure is demonstrated to reduce human-wildlife conflicts that can leas to nest abandonment and/or area avoidance.

- Inventory for and prohibit construction or other intrusive activities within ½ mile of an active raptor nest during the nesting season.

- Minimize the number of well-monitoring trips, by coordinating well visits to limit traffic or installing automated monitoring systems. This measure reduces human/wildlife conflicts and loss of habitat effectiveness.

- Conduct all construction and routine heavy maintenance of facilities May 1 to December 25. Operations of this nature outside the period will be evaluated upon written request to the FS or BLM for such consideration. This measure reduces human/wildlife conflicts and loss of habitat effectiveness during the critical winter season.

- Fence and place solid or mesh covers over reserve pits, to exclude and protect wildlife species form drilling fluids. Properly designed covers have been shown to be effective and are commonly used throughout the industry for these purposes.

- Gate all new access roads. Require all industry personnel passing through locked gates to close and re-lock each gate immediately upon passage. Road closures reduce the risk of mortality, displacement, and impacts to wildlife habitat effectiveness.

- Permanently close all roads that are not designated as open in the travel management plan, not used by industry to access CBM sites, and not used for administrative purposes. Block roads at least one site distance up the roadbed by placement of large boulders, livestock gates, or earthen barriers interspersed with tree trunks and branches, or obliterated and recontoured back to the original slope. This mitigation would offset the impact of new roads. In most cases, this mitigation has been effective in deterring public motorized traffic, thereby reducing wildlife displacement, mortality, and loss of habitat effectiveness.

- Upon road decommissioning, obliterate roads and re-contour back to original slope. This measure, in concert with road, closures, and off-road travel restrictions would somewhat restore pre-project conditions and improve habitat effectiveness for wildlife.

- Restrict well access roads not designated as open to the public to authorized CBM operations only. Also prohibit CBM employee use of recreational off road vehicles unless such equipment is necessary for job performance (Bromley 1985). This mitigation reinforces standard working agreements with industry. It is believed this mitigation would be effective maintaining habitat capability and reducing wildlife mortality and dispersal.

- Require all trash be transported off-site daily or stored in bear proof containers (McClellan and Shackleton 1988). This requirement shall apply to all compressor sites, well pads and other infrastructure sites during the construction phase. No overnight storage of wildlife attractant materials shall be permitted at any infrastructure sites during the production phase. This mitigation would effectively reduce habituation by wildlife to human food sources.

- To the extent practicable, use noise reduction technologies at all infrastructure sites during construction and production phases. It is believed this mitigation would be effective in reducing some of the wildlife displacement that may occur from areas immediately adjacent to infrastructure facilities (Harding and Nagy 1980).

- Schedule routine maintenance activities to occur between 0900 to 1300 hours at facilities in big game winter ranges during critical seasons and at facilities that must be accessed by roads through sensitive habitat.

- Remove all chemicals from project sites to avoid exposure to wildlife. This would allow wildlife to forage in developed areas without risk of exposure to harmful chemicals.

- Re-seed unused portions of roads and well pads as quickly as possible after disturbance with native grass, shrub, and forb seed mixtures to encourage faster re-growth of native nesting and foraging habitat in disturbed areas. Re-seeding immediately after disturbance has been shown to significantly reduce the time for reestablishment of vegetation on disturbed sites, thereby restoring wildlife forage and hiding cover more quickly than solely natural re-seeding.

- Restrict the use of open reserve pits during drilling unless absolutely necessary. Where possible, capture all liquid in containers and dispose of in an approved manner. Where reserve pits are necessary during drilling, cover all pits with mesh or other covers that prevent bird and mammal entry. If reserve pits are necessary, properly designed covers have been shown to be effective in excluding wildlife and are commonly used by industry for this purpose. Conduct spot checks to assure proper designs are used.

- All mitigation measures described in Section 3.1.4 (*Mitigation and Monitoring*), Section 3.6 (*Surface Water Resources*), and Section 3.7 (*Soils*) intended to reduce sediment inputs to surface waters are applicable to aquatic habitat and fisheries. No additional measures are recommended for brown trout.

- Add additional, site-specific mitigation measures to protect wildlife and their habitats to individual APDs as Conditions of Approval, as conditions warrant.

The following mitigation measures apply to the individual species presented below:

J.3.3.1 Abert's Squirrel

- Minimize impacts to squirrel nesting habitat to the extent practical in consideration to other wildlife species. This is expected to maintain nesting-habitat components effectively for the squirrel within the analysis and standards and guidelines found in Forest Plan direction.

J.3.3.2 Elk and Deer

- Where possible, select non-critical and lower use wildlife habitats over critical, important, and high use habitats. One possible means is to use slant-drilling methods.

- Minimize fencing. However, where necessary, install fencing that reduces wildlife mortality and movement while meeting other objectives. Example of a cattle control deer fence: 36 inches tall, three strand barbed wire fence with top wire being smooth. Spacing of wires from top to bottom: 10 inches, 10 inches, and 16 inches. Place fence posts 16.5 feet apart with twist-on wire stay halfway between posts.

- Enhance existing big game winter range in suitable undisturbed portions of the Project Area to reduce effective loss of winter range.

J.3.3.3 Hairy Woodpecker and Bluebird

- Where possible, protect all large-diameter (greater than 16 inch diameter at breast height [d.b.h.]) standing snags from loss to construction activities, especially in ponderosa pine stands. Where no large-diameter snags exist, protect all snags in the largest 10 percent of the stand's diameter class. Preference for large-diameter snags or the largest diameter available has been well documented for many cavity constructor species. This mitigation would minimize the loss of snags thereby reducing impacts to snag-dependant wildlife. Snag protection measures are expected to maintain average snag densities and distributions within the overall Project Area.

- Inventory for and where possible protect all nest cavity trees from loss to construction activities, especially in ponderosa pine stands. Studies have shown a preference for ponderosa pine by cavity constructor species. Because cavity trees are used consistently for many years, this protection measure is expected to be an effective tool for minimizing the impact of project implementation on cavity-dependant wildlife while maintaining actively used nest cavity sites.

- Protect as many large-diameter (greater than 16 inches d.b.h.) live trees with defects as possible to serve as replacement snags, especially those trees with

heartwood decay, spike-topped trees, broken-topped trees, and hollow trees. Preference for large-diameter snags has been well documented for many cavity constructor species. This mitigation is expected to maintain live snag-replacement trees of sufficient diameter within the Project Area to maintain long-term habitat value for snag-dependant wildlife.

- Prohibit cutting of standing dead ponderosa pine personal use firewood. This measure is designed to protect snags for cavity dependent wildlife species.

J.3.4 Monitoring

Monitoring conducted in the HD Mountains is two phased in terms of objectives. First, implementation monitoring would be conducted through the life of the project to determine and maintain project compliance with the mitigation requirements set forth above and elsewhere in Chapter 2, particularly public compliance with road closures and travel management restrictions, industry compliance with surface use mitigation required as APD conditions of approval, and compliance with rehabilitation and weed control requirements.

Second, the Forest Service has conducted inventories and monitoring for selected wildlife species in 2002 and 2003 to establish species presence and relative abundance and to sample species densities where feasible. Species inventoried and monitored include Abert's squirrel, green-tailed towhee, hairy woodpecker, mountain bluebird, and northern goshawk. The FS, in addition, has consulted with the Colorado Division of Wildlife (CDOW) on available inventory, monitoring, and/or species status information for Abert's squirrel, brown trout, elk, and mule deer.

The FS will continue monitoring of Abert's squirrel annually or every other year. Monitoring of green-tailed towhee, hairy woodpecker, and mountain bluebird will occur on an annual basis for at least the first two years after project construction, and every five years thereafter. Monitoring will assess mitigation effectiveness, species response to project implementation, and compliance with Forest Plan standards and guidelines. Monitoring will also contribute information to overall population monitoring occurring simultaneously across the SJNF.

The FS will continue intra-agency coordination with CDOW to obtain available monitoring or status information on brown trout, elk, and mule deer within the Project Area and across the SJNF. As with the other MIS, monitoring of mitigation measures recommended for game species will be conducted to determine effectiveness, and need for change.

Snag surveys are recommended around project infrastructure facilities (well pads, compressor stations, primary roads, spur roads, etc.) as well as away from project roads and infrastructure to monitor compliance with Forest Plan snag density standards and guidelines. Surveys would quantify the number, diameter, condition class and density of snags and specifically target ponderosa pine stands as well as the density of trees larger than 16 inches d.b.h. Surveys at infrastructure sites should be conducted prior to construction activities within areas to be cleared to gauge the impacts of project implementation and the relationship to Forest Plan standards and guidelines.

Due to the low threat to brown trout populations, population monitoring is not recommended. Implementation and effectiveness monitoring of watershed and soil BMPs is strongly recommended.

J.3.5 Site-Specific Design Features and Mitigation Measures

Two levels of environmental-protection measures are specified in the EIS. The first includes mitigation measures specified in Chapter 3 of the EIS and above that apply to project implementation in general. The second level includes mitigation measures that are applied to specific well locations after the companies have filed Applications for Permit to Drill (APDs), and site inspections are completed. The APDs must be consistent with the environmental-protection measures provided in the EIS Record of Decision, and will be modified to address specific issues that are identified during on-site inspections of the proposed well site.

J.4 MIS Addressed in Detail

The MIS addressed in detail in this analysis are Abert's squirrel, brown trout, elk, green-tailed towhee, hairy woodpecker, mountain bluebird, and mule deer. Each of these species, except the green-tailed towhee and mountain bluebird, is known or suspected to occur in the Project Area year-round. Typically the green-tailed towhee and mountain bluebird occupy the Project Area during spring and summer. Mountain bluebirds may also use the area during fall migration. Many of these species disperse outside the Project Area, where they use suitable habitats for food and cover.

The selected MIS represent larger groups of species that are grouped into three categories: early-, mid-, and late-successional species. Early-successional species, such as mountain bluebird, pocket gophers, and voles, are associated with the early stages of vegetation development (dominated by grass, forbs, shrubs, and tree seedlings) where suitable cover is available. Mid-successional species, such as green-tailed towhee and warbling vireo, thrive in young (dominated by pole-sized trees), healthy forest environments. Late-successional species, such as Abert's squirrel, hairy woodpecker, and flammulated owl thrive in mature and late-successional forests where they find adequate food and cover. Many species, such as blue grouse, Steller's jay, mule deer, and elk are associated with a variety of habitats and successional stages for food and cover, and are considered habitat generalists.

The SJNF recently completed Forest-wide MIS assessments for all the terrestrial species evaluated in this analysis. Each of the following specie analyses tier to the Forest-wide assessments. The Forest-wide assessments contain additional specie background and regional information, species population trend and habitat trend information and population/habitat correlation analysis.

J.4.1 Affected Environment

This section describes the wildlife habitats in the Project Area. (See also Chapter 3, Vegetation)

J.4.1.1 MIS Habitats

Wildlife habitats on NFS land (49,404 acres) generally are large, contiguous habitat blocks with minimal human development. Wildlife habitats at lower elevations consist primarily of Gambel oak, mountain shrub, and piñon-juniper, with scattered grassland parks. Ponderosa pine and mixed-conifer forests are present at moderate and higher elevations. Mixed-conifer stands, particularly those on mesic sites on northerly aspects, are generally small and isolated from similar habitats in the San Juan Mountains to the north.

Past and current activities, such as livestock grazing, CBM development, timber harvest, recreational use, and fire management, have influenced the quantity and quality of wildlife habitats. The combination of all activities has not occurred to such an extent that substantial alteration or fragmentation of habitats has resulted, and therefore has not likely adversely affected wildlife populations.

Habitats on BLM (6,671 acres) and State land (4,462 acres) comprise Gambel oak, mountain shrub, and piñon-juniper. These habitats generally are small to moderately sized blocks that are often surrounded by highly fragmented habitats on private land. Because of this interspersed jurisdiction, BLM and State land generally is important habitat for species to disperse into and shield themselves from human disturbances on private land. Past and current management activities and their influences on wildlife are similar to those described for NFS lands.

Wildlife habitats on private land (64,811 acres) are primarily agricultural fields, grasslands, Gambel oak, mountain shrub, piñon-juniper, and ponderosa pine. These habitats have undergone a much higher level of alteration and fragmentation than other jurisdictions because of past and present human development activities, such as agriculture, construction of roads, residential development, and others. For this reason, the quality of wildlife habitats has been reduced to varying degrees, and wildlife species using these habitats have had to develop a much higher level of tolerance to human activities.

The quantity and quality of MIS habitats can be estimated by determining the areal extent and distribution of habitats within successional stages. We determined the extent and distribution of vegetation within each successional stage on NFS land using habitat structural stage (HSS) information from the SJNF Common Vegetation Unit (CVU) GIS database. Table J–4 presents the distribution of HSSs on NFS land in the Project Area.

There is acreage that is in category 5 on NFS land. However, no similar, comprehensive vegetation database exists for BLM, state, or private land. Consequently, HSSs in these jurisdictions were developed based on professional judgment. We assigned data on vegetation types to HSSs in the same proportions that these HSSs were present on NFS land. Table J–5 shows the distribution of HSSs on all land in the Project Area. Early-successional stages consist of vegetation dominated by grasses, forbs, shrubs and tree seedlings, saplings, and poles (HSS 1, 2,

3A, 3B, and 3C), mid-successional stages consist of mature trees (HSS 4A, 4B, and 4C), and the single late-successional stage consists of large trees typically found in older mature and overmature forests (HSS 5).

The quantity and quality of habitats for MIS were estimated by evaluating HSS matrices as described by Towry (1984) and by using professional judgment based on field reconnaissance. Table J–6 shows the HSSs used by each MIS in this analysis. Table J–7 shows the acreage and proportion of suitable habitats for each MIS species on NFS land in the Project Area. Table J–8 shows the acreage and proportion of suitable habitats for each MIS species on all land in the Project Area.

Table J–4 Existing HSS on NFS Land in the Project Area

	Structural Stage (acres)										
Vegetation Type	N/a	1	2	3A	3B	3C	4A	4B	4C	5	Total
Grasslands	0	3,243	0	0	0	0	0	0	0	0	3,243
Sagebrush	0	0	1,358	0	0	0	0	0	0	0	1,358
Piñon-Juniper	0	0	0	2,167	4,491	0	1,742	1,250	0	0	9,650
Mountain Shrub	0	0	437	0	0	0	0	0	0	0	437
Gambel Oak	0	0	9,757	0	0	0	0	0	0	0	9,757
Ponderosa Pine	0	0	0	255	538	39	9,610	8,745	55	0	19,244
Mixed Conifer	0	0	0	18	857	108	364	2,546	463	0	4,355
Aspen	0	0	0	276	410	19	102	426	21	0	1,255
Riparian	0	0	3	0	0	0	23	0	0	0	26
Agriculture	0	0	0	0	0	0	0	0	0	0	0
Barren	78	0	0	0	0	0	0	0	0	0	78
Water	2	0	0	0	0	0	0	0	0	0	2
Total	80	3,243	11,555	2,717	6,297	166	11,841	12,967	540	0	49,404

Table J–5 Existing HSS on All Land in the Project Area

	Structural Stage (acres)										
Vegetation Type	N/a	1	2	3A	3B	3C	4A	4B	4C	5	Total
Grasslands	0	12,814	0	0	0	0	0	0	0	0	12,814
Sagebrush	0	0	12,017	0	0	0	0	0	0	0	12,017
Piñon-Juniper	0	0	0	5,818	12,058	0	4,678	3,355	0	0	25,909
Mountain Shrub	0	0	2,666	0	0	0	0	0	0	0	2,666
Gambel Oak	0	0	18,979	0	0	0	0	0	0	0	18,979
Ponderosa Pine	0	0	0	458	966	71	17,254	15,702	100	0	34,550
Mixed Conifer	0	0	0	19	900	113	382	2,674	487	0	4,574
Aspen	0	0	0	290	431	20	107	447	22	0	1,318
Riparian	0	0	73	0	0	0	600	0	0	0	673
Agriculture	9,343	0	0	0	0	0	0	0	0	0	9,343
Barren	2,320	0	0	0	0	0	0	0	0	0	2,320
Water	183	0	0	0	0	0	0	0	0	0	183
Total	11,847	12,814	33,735	6,586	14,355	204	23,021	22,178	608	0	125,348

Table J–6 Management Indicator Species Habitat Associations

Vegetation Type	Abert's Squirrel	Brown Trout	Elk	Green-tailed Towhee	Hairy Woodpecker	Mountain Bluebird	Mule Deer
Grasslands			✓			✓	✓
Sagebrush			✓	✓		✓	✓
Piñon-Juniper			✓	✓[1]	✓[2]	✓[3]	✓
Mountain Shrub			✓	✓		✓	✓
Gambel Oak			✓	✓		✓	✓
Ponderosa Pine	✓[2]		✓	✓[4]	✓[2]	✓[3]	✓
Mixed Conifer			✓		✓[2]	✓[3]	✓
Aspen			✓	✓[6]	✓[2]	✓[7]	✓
Riparian			✓			✓	✓
Agriculture							
Barren							
Water		✓					

Table J–7 Extent and Proportion of NFS Land in the Project Area Providing Habitats for Management Indicator Species

Species	Preferred Habitats	Habitats on NFS Land (acres)	Portion of NFS land (percent)
Abert's squirrel	Mid- and late-successional ponderosa pine habitat.	18,411	37
Brown trout	All rivers and creeks within the Project Area may contain suitable habitat, including the Piedra, Pine, Animas, and Florida Rivers.	2	<1
Elk	All early-, mid-, and late-successional habitats. The Project Area provides important winter range.	49,324	99
Green-tailed towhee	Early- and mid-successional habitats, in sagebrush, Gambel oak, and mountain shrub.	30,668	61
Hairy woodpecker	Mid- and late-successional ponderosa pine, aspen, and mixed conifer with large snags for cavity nesting.	25,467	51
Mountain bluebird	Early-, mid-, and late-successional habitats including sagebrush, mountain shrub, Gambel oak, piñon-juniper, riparian, aspen, and ponderosa pine. Dependent on snags for cavity nesting. May also nest in green trees if a suitable cavity is available.	15,730	33
Mule deer	All early-, mid-, and late-successional habitats. Project Area provides important winter range.	49,324	99

Table J–8 Extent and Proportion of the Project Area Providing Habitats for Management Indicator Species

Species	Preferred Habitats	Habitats in Project Area (acres)	Portion of Project Area (percent)
Abert's squirrel	Mid- and late-successional ponderosa pine habitat.	33,055	26
Brown trout	All perennial streams within the Project Area may contain suitable habitat including the Piedra, Pine, Animas, and Florida Rivers.	183	<1
Elk	All early, mid, and late-successional habitats. The Project Area provides important winter range.	113,501	91
Green-tailed towhee	Early- and mid-successional habitats, in sagebrush, Gambel oak, and mountain shrub.	75,156	60
Hairy woodpecker	Mid- and late-successional ponderosa pine, aspen, and mixed conifer with large snags for cavity nesting.	59,231	47
Mountain bluebird	Early-, mid-, and late-successional habitats including sagebrush, mountain shrub, Gambel oak, piñon-juniper, riparian, aspen, and ponderosa pine. Dependent on snags for cavity nesting. May also nest in green trees if a suitable cavity is available.	59,859	48
Mule deer	All early-, mid-, and late-successional habitats. Project Area provides important winter range.	113,501	91

The extent of MIS habitats in the cumulative-effects analysis area is shown in Table J–9. As with non-NFS land in the Project Area, HSSs data were not available for the cumulative-effects analysis area. We developed HSSs in these other areas based on professional judgment. Data on vegetation types were assigned to HSSs in the same proportions that HSSs are present on NFS land. In several cases, the Southern Ute Indian Tribe (SUIT) EIS used broad vegetation categories, rather than the more tightly defined vegetation types used in this analysis. Vegetation categories from the SUIT EIS were split by using the proportion of occurrence of each of the more distinct vegetation types in the Project Area. The SUIT EIS did not distinguish open-water habitats from wetland and riparian habitats; therefore, no data on habitats for the brown trout in the cumulative-effects analysis area are presented.

Table J–9 Extent and Proportion of the Cumulative-Effects Analysis Area Providing Habitats for Management Indicator Species

Species	Habitats in Project Area (acres)	Habitats in SUIT Study Area (acres)	Habitats in Cumulative-Effects Analysis Area (acres)	Portion of Cumulative-Effects Analysis Area (percent)
Abert's squirrel	33,055	16,173	49,228	9
Brown trout	183	Unknown	Unknown	<1
Elk	113,501	354,929	468,430	86
Green-tailed towhee	75,158	232,737	307,856	56
Hairy woodpecker	59,231	63,019	122,250	22
Mountain bluebird	59,895	284,100	343,995	63
Mule deer	113,501	354,929	468,430	86

J.4.2 Environmental Consequences

J.4.2.1 Summary of Effects

J.4.2.1.1 Habitat Loss

Direct wildlife habitat loss would occur under each alternative during the construction phase of the project, as a result of road, well pad, and other facility construction. Habitat loss would reduce available forage and habitat components in the affected area. Habitats next to those directly disturbed may be degraded by changes in vegetation, including the invasion of noxious weeds.

The direct loss of habitat is would correlate with the number of wells, roads, and other facilities constructed under each of the alternatives. Alternative 2 would result in the greatest habitat loss, followed in descending order by Alternatives 1, 1A, 1B, 4, 3, and 5. Certain habitat types would be affected more than others under the alternatives (Table J–12), but, overall, there would not be a direct loss of habitat in excess of 2 percent for any species across the Project Area as a result of new CBM development.

The bulk of new-habitat impact would be on NFS land, because it is currently the least developed and would experience most of the new development. The west side of the Project Area is extensively developed as agricultural and residential land and has seen the most CBM development to date. Future CBM development on the west side of the Project Area would add a small increment of direct habitat loss to the landscape. In an effort to return habitats to wildlife use, unused portions of well sites would be restored during the production phase. At the end of the production phase, all facilities would be removed and disturbed areas restored.

How long impacted land would be unsuitable as wildlife habitat is variable and would depend on well lifespan, restoration techniques and success, and local weather. Restoration of habitats dominated by grasses and forbs should be suc-

cessful within several years, habitats dominated by shrubs and trees may take decades or more, however, to successfully reestablish. Restoration of mature- and old-growth forest characteristics, where these habitats are impacted, would require hundreds of years following abandonment and final reclamation. Consequently, the disturbance of forest and shrub habitats would represent a long-term loss beyond the end of the production phase to those species that depend on such vegetation for forage or shelter. In addition, a small amount of the roads constructed for gas field development would not be reclaimed, but would be maintained as part of the permanent road system, resulting in permanent loss of wildlife habitats. Some existing roads in the National Forest portion of the Project Area have been removed from the permanent road system and will revert to suitable habitat conditions over time.

J.4.2.1.2 Habitat Trend

Each alternative would impact a small amount of habitat for most species. The amount of habitat for each MIS that is available and that would be lost on NFS land in the Project Area under each alternative is presented in Table J–10. The proportion of NFS land that is suitable for each MIS, and the proportion of suitable habitats that would be lost on NFS land in the Project Area under each alternative, are shown in Table J–11. The amount of habitat for each MIS that is available and that would be lost in the Project Area under each alternative is shown in Table J–12. The proportion of the Project Area that is suitable for each MIS, and the proportion of suitable habitats that would be lost in the Project Area under each alternative, are shown in Table J–13.

The MIS analysis is also concerned with habitat trend over the SJNF and the relationship of project-level impacts on overall Forest trends for MIS species. Table J–14 describes the Forest-wide trend for the selected MIS. The project would not contribute appreciably to a change in this habitat trend.

J.4.2.1.3 Population Trend

Reduced population is generally a concern if a substantial proportion of available habitats is lost or reduced in effectiveness for a long period. Substantial losses of habitat are not predicted for any of the alternatives on NFS land, or in the Project Area (Table J–10 through Table J–14). On private lands, there may be species population impacts in the Project Area's west side, where residential and agricultural development have impacted habitats and have accelerated over the past decade.

The population trend analysis follows the conceptual framework presented by Ruggiero et al. (1994), using knowledge of a species' ecology to examine the effects of management actions on the species' habitats and population biology. The outcome is an informed judgment of the effects of the management action on population trend in the analysis area (Ruggiero et al. 1994). Quantitative and qualitative assessments, based on the SJNF Forest-wide MIS assessments, the results of this impact assessment, and professional judgment, are shown in Table J–15.

Table J–10 Amount of Habitats Available and Affected by each Alternative for each MIS on NFS Land in the Project Area

MIS	Habitats Available (acres)	Habitats Affected (acres)				
		Alt. 1	Alt. 2	Alt. 3	Alt. 4	Alt. 5
Abert's squirrel	18,411	337	465	206	172	66
Brown trout	2	0	0	0	0	0
Elk	49,324	724	1,150	400	408	91
Green-tailed towhee	21,593	258	487	120	164	18
Hairy woodpecker	25,324	424	616	241	225	68
Mountain bluebird	42,585	636	1,016	358	350	82
Mule deer	49,324	724	1,150	400	408	91

Table J–11 Proportion of Habitats Available and Affected by each Alternative for each MIS on NFS Land in the Project Area

MIS	Habitats Available (percent)	Habitats Affected (percent)				
		Alt. 1	Alt. 2	Alt. 3	Alt. 4	Alt. 5
Abert's squirrel	37	1.8	2.5	1.1	0.9	0.4
Brown trout	<1	0.0	0.0	0.0	0.0	0.0
Elk	99	1.5	2.3	0.8	0.8	0.2
Green-tailed towhee	44	1.2	2.3	0.6	0.8	0.1
Hairy woodpecker	51	1.7	2.4	1.0	0.9	0.3
Mountain bluebird	86	1.5	2.4	0.8	0.8	0.2
Mule deer	99	1.5	2.3	0.8	0.8	0.2

Table J–12 Amount of Habitats Available and Affected by each Alternative for each MIS in the Project Area

MIS	Habitats Available (acres)	Habitats Affected (acres)				
		Alt. 1	Alt. 2	Alt. 3	Alt. 4	Alt. 5
Abert's squirrel	33,055	373	565	244	212	101
Brown trout	183	3	3	3	3	3
Elk	113,501	967	1,671	644	654	316
Green-tailed towhee	58,559	433	817	293	338	177
Hairy woodpecker	45,207	492	769	311	296	132
Mountain bluebird	98,652	829	1,460	553	548	263
Mule deer	113,501	967	1,671	644	654	316

Table J–13 Proportion of Habitats Available and Affected by each Alternative for each MIS in the Project Area

MIS	Habitats Available (percent)	Habitats Affected (percent)				
		Alt. 1	Alt. 2	Alt. 3	Alt. 4	Alt. 5
Abert's squirrel	26	1.1	1.7	0.7	0.6	0.3
Brown trout	<1	1.6	1.6	1.6	1.6	1.6
Elk	91	0.9	1.5	0.6	0.6	0.3
Green-tailed towhee	47	0.7	1.4	0.5	0.6	0.3
Hairy woodpecker	36	1.1	1.7	0.7	0.7	0.3
Mountain bluebird	79	0.8	1.5	0.6	0.6	0.3
Mule deer	91	0.9	1.5	0.6	0.6	0.3

Table J–14 MIS Habitat Trends

MIS	Current Trend	Future Trend
Abert's squirrel	Stable	Same
Brown trout	Decreasing	Same
Elk	Decreasing	Same
Green-tailed towhee	Slight upward	Same
Hairy woodpecker	Slight upward	Same
Mountain bluebird	Stable	Same
Mule deer	Decreasing	Same

Table J–15 MIS Population Trends

MIS	Current Trend	Predicted Future Trend
Abert's squirrel	Stable	Stable or slightly decreasing
Brown trout	Decreasing	Stable or Decreasing
Elk	Stable	Stable to Decreasing
Green-tailed towhee	Stable	Stable or slightly increasing
Hairy woodpecker	Stable	Stable or slightly decreasing
Mountain bluebird	Stable	Stable or slightly increasing
Mule deer	Stable (but variable)	Stable (but variable)

J.4.2.1.4 Activities Contributing to Cumulative Effects

The cumulative effects of CBM development are of concern. The general cumulative effects analysis area is defined as the Project Area (125,000 acres) and that portion of the Southern Ute Indian Reservation that has seen and will continue to experience CBM development over the next decade (422,000 acres). The cumulative effects study area for wildlife is therefore 547,000 acres, encompassing the Colorado portion of the San Juan Basin.

The cumulative-effects analysis considers the environmental consequences of conventional and CBM gas development across both study areas. It also considers other past, current, and projected actions and trends that may contribute synergistically to cumulative impacts. Each of the alternatives would contribute to cumulative wildlife impacts in the Colorado portion of the San Juan Basin. Other activities that have contributed and that may contribute to cumulative impacts are rural and urban housing development, timber harvest, fire management, livestock grazing, recreation, agriculture, and road construction. These activities and the concerns they present are discussed below.

Oil and gas development is projected to continue both in and south of the Project Area. Industry's Proposed Action involves drilling 296 additional CBM wells over the next decade within the Project Area, as described in Chapter 2. South of the Project Area, within the bounds of the Southern Ute Reservation, 367 additional CBM infill wells, 70 injection wells for enhanced coal bed methane projects, and associated facilities are projected for Tribal mineral estate, and 586 wells are projected for non-Tribal mineral estate. Other reasonably foreseeable oil and gas development includes development in the New Mexico portion of the San Juan Basin (CBM, conventional gas, and oil). We do not predict wildlife movement and migration between the Colorado and New Mexico portions of the San Juan Basin. Therefore, the cumulative wildlife effects analysis focuses on the Project Area and SUIT Reservation.

Community expansion continues to encroach on wildlife and habitats. In La Plata County, it is expected to include growth in residential population; related increases in commercial operations and development of county roads; and small, industrial developments unrelated to mineral resources. No major industrial project, such as a power plant or new factory, is foreseen in La Plata County. Instead, community growth is expected in the form of an influx of individuals, families, and retirees attracted to the Four Corners-area lifestyle. Population will continue to be concentrated in Durango, Bayfield, and Ignacio, but residential development will also continue to encroach on agricultural and forested lands, especially in the central and northern parts of the county. Gas development is already spread throughout the area where the San Juan Basin overlaps the county.

The effects of timber harvest and fire suppression are of concern in the National Forest portion of the cumulative-effects area in the HD Mountains. Timber harvest, when taken in concert with other vegetation- or ground-disturbing activities such as oil and gas development, can impact wildlife and their habitats cumulatively. Records of past timber harvest activity indicate that between 1941 and 1996, 6,870 acres of ponderosa pine and mixed conifer was harvested in the Project Area on NFS land. Approximately 1,535 acres of ponderosa pine and Douglas-fir was converted by harvests to different vegetation types, including grasslands (103 acres), mountain shrub (55 acres), sagebrush (237 acres), Gambel oak (895 acres), piñon-juniper (214 acres), riparian (5 acres), and barren (26 acres). These treatments benefited early-successional wildlife species, to the detriment of those that thrive on older, forested ecosystems. Periodic timber harvests and thinning on small tracts of private and Reservation land contribute to maintaining younger age classes of ponderosa pine, as is the case on most of the SJNF.

A current National Forest timber sale straddles the northeastern border of the Project Area. Cutting activities began the summer of 2003 and will ultimately result in thinning of 157 acres of ponderosa pine. After harvest, a 500-acre prescribed burn is planned to reduce fuels and enhance pine regeneration. Three additional vegetation-treatment projects are in various stages of planning. The Forest Service is analyzing ponderosa pine fuels-restoration treatments in the Fosset Gulch, Sauls Creek, and Lange Canyon areas. None of these activities is expected to affect MIS detrimentally, either individually or cumulatively. Indeed, each is designed to maintain the health and resilience of forested ecosystems. This is important when factoring in the effects of other impacting activities.

Fire suppression has been the overriding strategy for dealing with fires in the Project Area since settlement in the late 1800s. This strategy has produced a somewhat unnatural mix of vegetation, in terms of structure and density. There are generally more small-diameter trees and shrubs present today than there would be, had fire played a role in the last 100 years. Fire exclusion results in fewer, larger stems of Gambel oak, for example. This limits the moisture and sunlight available for grasses and forbs to grow. The changes in vegetation cover resulting from fire suppression are an important consideration in terms of evaluating the cumulative impacts of management prerogatives and projects on wildlife MIS.

Somewhat offsetting fire suppression effects are prescribed fires conducted in the HD Mountains over the past 16 years that treated close to 10,500 acres. The primary effect on vegetation was to top-kill Gambel oak. No significant changes in tree-canopy closure or density occurred because of these burns, and consequently there was no immediate effect, but we do expect long-term benefits to MIS species from these projects.

The immediate Project Area includes all or part of six active cattle-grazing allotments and two closed grazing allotments. Project Area allotments are managed with rotation grazing systems. Some allotments are used only 30 days in the spring; others the entire season, with deferment of pastures during certain periods of the growing season. Stock ponds, herding, salting, fencing, and geographical barriers are the primary means of controlling livestock distribution. Range monitoring shows an upward trend, in terms of species composition and cover, to the benefit of MIS.

A broad spectrum of recreation occurs year-round in the Project and cumulative-effects area. Summer activities include hiking, mountain biking, hunting, fishing, camping, sightseeing, ATV riding, and wildlife viewing. Both BLM and National Forest land are open seasonally to ATVs. Expansion of the road system, particularly on the National Forest, can attract additional motorized recreation use and would open up significantly more country than is currently accessed by roads. Areas easily accessible from Durango and Bayfield, such as Sauls Creek, are also expected to see increased day use for picnicking, hiking, mountain biking, and horseback riding because of increases in nearby populations. Increased human use of the Project Area over time can result in wildlife harassment and, in the extreme, to habitat displacement. There is no indication that displacement is occurring now, and control of human access to the Project Area must be considered in mitigating these wildlife concerns in the future.

The cumulative effects of other activities on private land, such as ranching and agriculture, cannot be quantified, because of a lack of formal study, but are discussed qualitatively.

J.4.2.2 Abert's Squirrel

This section discusses the species biology, the direct, indirect, and cumulative effects of the alternatives, and relationship of project impacts to Forest-wide habitat and population trends for Abert's squirrel. Suitable Abert's squirrel habitat is limited to mid and late successional ponderosa pine forests – habitat structural stages 4A, 4B, 4C, and 5 of the ponderosa pine type (Table J–6). The squirrel is unique in that its life necessities are almost entirely provided by a single plant species, ponderosa pine. Consequently, the assessment of ponderosa pine habitat change is the most practical, effective way to measure and monitor Albert's squirrel population trend. The habitat-modeling process follows the protocols of Hoover and Wills (1984). Population limiting and controlling factors include activities such as insect and disease infestations, timber harvest prescribed fire, oil and gas development, and livestock grazing that affect ponderosa pine habitat, all of which have the potential to affect food source and nesting availability. Other population influencing factors include hunting and vehicle collision.

J.4.2.2.1 Species Biology and Affected Environment

Abert's squirrel (*Sciurus aberti*) is limited to ponderosa pine forests and appears ecologically dependent on ponderosa pine for food, cover, and nest sites (Keith 1965). This squirrel is unique because its life necessities are almost entirely furnished by a single species of plant, ponderosa pine. Therefore, habitat monitoring is the most practical, cost effective way of monitoring Abert's squirrel population trend. Preferred habitats are stands of all-aged ponderosa pine with even-aged groups within the stands, open understories, and high canopy base levels (Patton 1975). Although these squirrels may be found in Gambel oak and piñon-juniper forest types, they frequent such types only when they are associated with ponderosa pine. Other species represented include the pygmy nuthatch, common nighthawk, Lewis' woodpecker, and flammulated owl.

Depending on the season, primary food sources are seeds, inner bark, terminal buds, and staminate flowers of ponderosa pine; fleshy fungi; and acorns from Gambel oak. Only foods from ponderosa pine and fleshy fungi are consumed in amounts important from a quantitative point of view (Keith 1965).

Home ranges vary by season and sex. Abert's squirrels are generally not territorial. A Colorado study found the mean home range to vary from 12 to 50 acres, winter ranges being smaller than summer ranges (Fitzgerald et al. 1994). Home ranges in several Arizona studies varied from 5 acres in the winter to 18 to 85 acres at other times (Keith 1965, Patton 1975). Males have larger home ranges than females, especially during breeding season.

The Abert's squirrel is not federally listed as threatened or endangered. Its Global Heritage Rating is G5 — "demonstrably secure globally." However, it may be quite rare in parts of its range, especially at the periphery (Colorado Natural Heritage Program [CNHP] 2002). Abert's squirrel populations are considered abundant and well distributed across the SJNF.

Classification of the Abert's squirrel as a game or nongame animal varies by state. Abert's squirrels are classified as game animals in Colorado, Arizona, and New Mexico. In contrast, they are protected in Utah and Wyoming. The Colorado hunting season for Abert's squirrels was established in 1977.

Although ponderosa pine is the most widely distributed pine type in North America, Abert's squirrel are absent from most of these forests. Their range extends from the foothills of the Rocky Mountains and the Colorado Plateau in the United States to the Sierra Madre Occidental from Northern Sonora and Chihuahua to Southern Durango in Mexico. Within the United States, they occur in New Mexico, Arizona, Colorado, and southern Wyoming.

Abert's squirrels are common in ponderosa pine forests of southern and central Colorado (Fitzgerald et al. 1994). Extensions of their range have occurred in recent years in southeastern and western Colorado (Mellott and Choate 1984, Davis and Bissell 1989). They are common throughout ponderosa pine habitats across the SJNF and the Project Area. CDOW considers its population status as secure and viable enough to support a hunting season. Inventories were conducted for the squirrel within the Pagosa Ranger District and within the national forest portion of the Project Area during 2002 and 2003. Within surveyed habitats, the Abert's squirrel was well distributed, showing more use within optimal habitats, as expected (Rhea 2003). Population monitoring will again occur in 2004 and will continue through the five years of Project implementation.

There are 18,411 acres of habitat for the Abert's squirrel on NFS land, encompassing 37 percent of the land in the Project Area (Table J–8). There are 33,055 acres of Abert's squirrel habitat in the Project Area, encompassing 26 percent (Table J–8). There are 16,173 acres of Abert's squirrel habitat south of the Project Area in the SUIT Study Area and, therefore, 49,228 acres in the cumulative-effects analysis area (Table J–9).

The largest blocks of habitat in the Project Area are on NFS land in the eastern half of the Project Area. The next-largest blocks of habitat are on private land in the northern half of the western portion of the Project Area. Habitat on BLM and State land is limited.

The Project Area does not provide unique and isolated habitats upon which the overall viability of Abert's squirrels is dependent. Suitable habitat is not contiguous throughout the Project Area on NFS land. It occurs generally in variously sized islands well distributed within the ponderosa pine vegetation type. For analysis and comparison, we assume this same distribution of suitable habitat within the ponderosa pine type exists for land of other ownership within the Project Area.

Approximately 30 Abert's squirrels are required for a minimally viable population (Towry 1984). These squirrels would require 429 acres of optimal habitat (HSS 4B, 4C, and 5) for a viable population. Given there is an estimated 16,518 acres of optimal habitat distributed throughout the Project Area, there is enough habitat to support an estimated 1,140 individuals. Actual populations will vary, due to variables such as habitat patch size, distribution, etc., but this estimate helps provide a basis of comparison for alternatives. Based on this index,

the Project Area supports far more than the minimum viable population of 30 squirrels.

J.4.2.2.2 Direct and Indirect Effects

Varying amounts of Abert's squirrel habitat and food source would be affected under each alternative (Table J–16). Habitat removal would resemble small, circular, rectangular, or square openings of about 1.5 to 3 acres at well pads and other facilities, and linear openings along road and utility corridors. Linear openings would be about 40 feet wide. All trees and other vegetation in these areas would be removed.

Table J–16 Extent and Proportion of Loss of Abert's Squirrel Habitats

	Alternative							Habitats Available (acres)
	1	1A	1B	2	3	4	5	
NFS land								
Acres	345	294	194	470	213	167	67	18,411
Percent	1.7	1.1	0.8	2.2	0.8	0.6	0.2	
Project Area								
Acres	383	331	227	571	250	204	100	33,055
Percent	1.1	0.8	0.7	1.8	0.6	0.4	0.1	

The direct and indirect effects on the squirrel displayed in Table J–17 would be small, ranging from no effect in one case, to minor (individuals not likely affected), to moderate (individuals may be affected, but populations would not be affected). In terms of direct habitat loss, Alternative 2 would be the most impacting, followed in descending order by Alternatives 1, 1A, 1B, 3, 4, and 5.

The habitat removal would be broadly distributed across the landscape and not focused in any one area. Overall, the CBM development alternatives would slightly decrease (remove 2-percent or less) the amount of habitat for Abert's squirrel and other ponderosa pine associated species, such as pygmy nuthatch, common nighthawk, Lewis' woodpecker, and flammulated owl.

The removal of squirrel habitat would disrupt the forest canopy and create more "edge" in the affected stands. More habitat edge would result in the loss of nesting and foraging habitat and a reduction in squirrel ability to travel the forest canopy by jumping from tree to tree. In terms of the duration of habitat loss, decades would pass before affected ponderosa pine stands mature, following the project's conclusion. This type of habitat loss would be more harmful to squirrels and other ponderosa-pine- associated wildlife that occupy stands that offer optimal habitat, such as those that do not currently contain well pads, roads, or other linear corridors.

Table J–17 Relative Impacts on the Abert's Squirrel, by Alternative

Factor	Alternative 1	1A	1B	2	3	4	5
Direct habitat loss							
Magnitude and Type of Effect[1]	Mod–	Mod–	Mod–	Mod–	Mod–	Mod–	Mod–
Ranking of Alternatives[2]	6	5	4	7	3	2	1
Home Range Shift and Displacement							
Magnitude and Type of Effect	Mod–	Mod–	Mod–	Mod–	Mod–	Mod–	Mod–
Ranking of Alternatives	6	5	4	7	3	2	1
Habitat Fragmentation							
Magnitude and Type of Effect	Minor–	Minor–	Minor–	Minor–	Minor–	Minor–	Minor–
Ranking of Alternatives	6	5	4	7	3	2	1
Increased Vulnerability to Predators/Vehicle Collision							
Magnitude and Type of Effect	Mod–	Mod–	Mod–	Mod–	Mod–	Mod–	Mod–
Ranking of Alternatives	6	5	4	7	3	2	1
Facilities-Related Mortality							
Magnitude and Type of Effect	Minor–	Minor–	Minor–	Minor–	Minor–	Minor–	Minor–
Ranking of Alternatives	6	5	4	7	3	2	1
Recreation							
Magnitude and Type of Effect	Mod+	Mod+	Mod+	Mod+	Mod+	Mod+	None
Ranking of Alternatives	6	5	4	7	3	2	1
Noise							
Magnitude and Type of Effect	Mod–	Mod–	Mod–	Mod–	Mod–	Mod–	Mod–
Ranking of Alternatives	6	5	4	7	3	2	1
Development Activity							
Magnitude and Type of Effect	Mod–	Mod–	Mod–	Mod–	Mod–	Mod–	Mod–
Ranking of Alternatives	6	5	4	7	3	2	1
Production Activity							
Magnitude and Type of Effect	Minor–	Minor–	Minor–	Minor–	Minor–	Minor–	Minor–
Ranking of Alternatives	6	5	4	7	3	2	1

Notes:
1. None = immeasurable effect or compensating adverse and beneficial effects, Minor = individuals not likely affected, Mod = (moderate) individuals may be affected but populations would not be affected, "–" = negative effect, "+" = positive effect. Thus, Mod– is a moderate negative effect.
2. Rankings are in order from the least impact (1) to the greatest impact (7).

Some displacement and shift in home ranges would be expected. This impact is expected to be moderate in all alternatives, affecting only individuals. Displacement of individuals, due to human disturbances associated with the construction would be short-term. These displacement impacts would result in some shift in home range areas for individuals, depending on duration of construction, magnitude of associated disturbance (such as noise), loss of habitat components, and individual tolerance of disturbance. Squirrels would be expected to reuse most of these areas following construction activities.

The alternatives would produce only minor habitat fragmentation because abundant squirrel habitats would remain next to disturbed areas and connected to other blocks of habitat. Newly constructed roads would not create insular habitats, because these narrow breaks do not form barriers to squirrel movement and dispersal. The presence of roads would, however, discourage regular use of these open areas for most daily activities.

While squirrel movement across corridors would not be affected significantly, there may be increased potential for predation or individual loss to vehicle collision as squirrels are exposed in these areas. We do not expect squirrels to use open areas extensively, but only occasionally for dispersal and to cross to patches of adjacent habitat. However, individuals would be susceptible to predators. Vehicle speeds and traffic volume on new roads would be low, due to design, terrain, and travel management restrictions. Incidents should not be a usual occurrence. Therefore, squirrel loss to predators and vehicle collisions probably would be moderate and not affect overall populations.

Minor, direct mortality of Abert's squirrels at well site facilities is possible. Squirrels would be exposed to the machines and toxic substances at these facilities. Mesh or other coverings over sources of poor-quality water can prevent ingestion by squirrels and other wildlife. It would be unusual for an Abert's squirrel to become entangled in the mechanical workings of a production facility, due to normal behavior and habitat preference.

Increased motorized recreational use that potentially follows CBM development may decrease squirrel habitat effectiveness. To reduce these impacts and impacts to other wildlife, the Forest Service and BLM would close many project roads to ATV and other motorized public uses and restrict ATVs to designated travel routes, thus eliminating current, motorized cross-country travel. Only authorized vehicles (mainly industry, agency, and law enforcement) would use most of the road system. On public land, the new road system would be open to horse and foot travel, thus opening foot and horseback access to previously lightly used portions of the Project Area. This type of recreational use is expected to be light to moderate. Abert's squirrels are generally tolerant of short-duration disturbance associated with dispersed recreational activities. They may be displaced short distances temporarily to adjacent habitat within the animals' home range, or exhibit a change in behavior (hiding) to avoid predators, which may temporarily disrupt other activities, such as foraging.

The Colorado Division of Wildlife regulates hunting, and the "take" is set to ensure sustained populations. The Abert's squirrel is not hunted extensively now; and hunting pressure is expected to drop overall in the Project Area, especially on NFS land due to decreased motorized access from new travel-management restrictions. Again, only individuals and not populations should be affected. The overall impact of travel-management changes is expected to be moderately positive for all alternatives except Alternatives 4 and 5, where no change in impact is expected.

Noise from development and production activities reduces habitat effectiveness both short- and long-term. Noise levels can vary significantly from background noise for various project functions. Noise associated with development, including drilling and road and facility construction, is considered short-term. Noise associated with the production phase (maintenance traffic, compressor stations, pump jacks, etc.) is generally long-term but would be measurably less than construction. Noise generated by pump jacks would decrease to 50 dBA at 300 feet; and noise from with building-enclosed compressors to 50 dBA at 450 feet from the building, both within COGCC noise guidelines (Chapter 3, Noise section).

Some habituation to consistent noise would occur for many wildlife species, moderating the loss of habitat effectiveness as they adjust to the noise. There are no scientific studies of the effects of noise on the Abert's squirrel. However, the species has not been observed to be extremely sensitive to noise. A buffer zone of reduced habitat effectiveness exists, surrounding areas producing high noise levels but the extent of avoidance is unknown. The magnitude of effect is considered moderate for all the alternatives. Noise levels may cause nearby individuals to shift their home range temporarily or permanently away from areas with noise levels above the species' tolerance level. Noise would not likely affect individuals or populations for the species in the Project Area.

To summarize, development activities, including construction of production facilities, may displace some individuals temporarily or permanently, but should not affect populations. The size, duration, and timing of the activity, and the tolerance of the individual, are variables in determining whether displacement is temporary or permanent for individuals.

Activities associated with production are much less impacting than those associated with development. Such activities include machinery movement, and typically one trip per day or less per well site, in a pickup-class to ensure equipment is maintained and operating. Sites with remote telemetry are visited less often. Production facilities such as compressors or injection wells may be visited more often, by larger-class vehicles, for longer periods of time. This activity is not likely to affect individuals, thus having a minor effect across all alternatives.

Table J–17 (above) summarizes the magnitude of positive or negative effects on the species and ranks alternatives in terms of these effects. Under each of the seven alternatives, the extent of the impacts discussed above would depend primarily on the number of wells that would be drilled and the length of access roads to these wells. As shown in Table J–17, the highest level of development would occur under Alternative 2; and consequently the alternative would display the highest level of squirrel impact. Alternatives 1, 1A, 1B, 3, 4, and 5 would have decreasing levels of impact, respectively. Abert's squirrel impacts would be relatively minor, affecting individuals but not populations across the Project Area.

J.4.2.2.3 Cumulative Effects

The past, present, and reasonably foreseeable cumulative effects on Abert's squirrel habitats are given in Table J–18. The level of existing habitat loss presented in Table J–18 includes past development in the cumulative-effects area and approved oil and gas development within the bounds of the Southern Ute Reservation. Cumulative effects are the sum of existing and approved development, plus development projected for each alternative. Oil and gas development within the cumulative-effects area would impact between 2.2 and 3.2 percent of available habitat.

Table J–18 Extent and Proportion of Cumulative Loss of Abert's Squirrel Habitat from Oil and Gas Development

	Existing Effects	Cumulative Effects							Habitats Available (acres)
		Alt. 1	Alt 1A	Alt 1B	Alt. 2	Alt. 3	Alt. 4	Alt. 5	
NFS land									
Acres	19	354	313	213	489	232	186	86	18,411
Percent	0.1	1.7	1.7	1.2	2.0	1.3	1.0	0.5	
Cumulative Effects Analysis Area									
Acres	1,064	1,425	1,316	1,265	1,575	1,259	1,208	1,111	49,228
Percent	2.2	2.9	2.7	2.6	3.2	2.5	2.4	2.2	

Past management activities on NFS land in the Project Area, such as fire suppression and timber harvest, have altered the availability of Abert's squirrel habitat beyond the cumulative loss associated with oil and gas development shown in Table J–18. Timber harvest over the past 60 years has converted 1,535 acres of ponderosa pine stands, and thus squirrel habitat, on NFS land in the Project Area to Gambel oak, grasslands, sagebrush, piñon-juniper, mountain shrub, riparian, and barren. Depending on the configuration of harvest, this could have affected individuals (if spread across small areas) or populations (if harvested in a few large, contiguous blocks).

The stand structure of another 4,960 acres of ponderosa pine was changed by harvest during this same period. The residual impact was negative over the short term and neutral over the long-term.

Fire suppression has also changed the structure of ponderosa pine stands. This has improved nesting habitat in some cases, where larger trees now have interlocking crowns. Some decrease in ground foraging habitat has been realized with the encroachment of oak brush and other shrub species into the understory. Whether the positive effects outweigh the negative for a given area is a site-specific call.

On non-NFS land, past agricultural and residential development and associated road construction in ponderosa pine stands has reduced more Abert's squirrel habitat than has oil and gas development. Habitat losses to agricultural and residential development may have been great enough to decrease populations within the western portion of the cumulative-effects analysis area. Lack of formal study prevents a quantitative analysis of these past effects. Anticipated residential growth suggests that ponderosa pine habitats will continue to be lost in the future on non-NFS land, further reducing the availability of Abert's squirrel habitat.

Continued fire suppression and timber harvest on private land occur in and affect Abert's squirrel habitat. Both have altered and would continue to alter forest conditions within the squirrel's distribution, with effects again resulting in a site-specific mix of positive and negative impacts. The extent of these effects is not quantifiable due to lack of applicable studies, but qualitatively, timber harvest and clearing for residential and agricultural development have likely reduced habitat.

Other cumulative effects such as reduced habitat effectiveness, vehicle collisions, individual mortality, and habitat fragmentation, are not quantifiable. The cause of these impacts on public and tribal land would be related primarily oil and gas development and road use, whereas on private land, residential and agricultural development are the major causative factors.

J.4.2.2.4 Relationship of Effects to Forest-wide Population and Habitat Trends

This section tiers to Forest-wide MIS Assessment and evaluates how implementation of the proposed project would contribute to Abert's squirrel population and habitat trends across the entire SJNF. Project level surveys show the species is well distributed in sampled habitats across the Project Area (Rhea 2003). CDOW considers the status of Abert's squirrel across the SJNF secure and viable enough to support a hunting season. Considering existing survey data and habitat distribution and trends across the Project Area and the entire SJNF, and the strong species/habitat relationship, the Abert's squirrel population is considered well distributed and stable across the SJNF.

The SJNF-wide MIS assessment for Abert's squirrel documented that all suitable habitats (ponderosa pine, HSSs 4A, 4B, 4C, and 5) on the entire SJNF were reduced by 0.4 percent over the past 20 years. The most extensive alternative (Alternative 2) results in 404 acres of habitat loss on NFS land. Changes in the 20-year, Forest-level, suitable-habitat trend caused by this project result in an almost imperceptible change of 16 hundredths of 1 percent. Thus, the Forest-wide suitable-habitat trend, and the life sustaining factors provided by habitat such as availability of nest sites and food source and secure habitat remains stable. The other alternatives would result in less change to the Forest-level, 20-year trend for suitable habitat than Alternative 2.

The SJNF-wide MIS assessment for Abert's squirrel documented that all optimal habitats (Ponderosa pine, HSSs 4B, 4C, and 5) on the SJNF were reduced by 2.8 percent over the past 20 year. An additional loss of optimal habitat for the most extensive alternative (Alternative 2) results in 270 acres of optimal-habitat loss. Changes in the 20-year, Forest-level, optimal-habitat trend from this project create an optimal-habitat loss of an additional 14 hundredths of 1 percent, leading to the conclusion that Forest trends for optimal habitat will remain stable. The other alternatives would result in less change to the Forest-level, 20-year trend for optimal habitat. The project would not contribute to a measurable change in habitat quality and distribution across the SJNF.

Habitats, food source, and nesting sites in the Project Area are distributed such that adequate dispersal and species interactions should continue under all alternatives. CBM development on NFS land within the project area would negligibly impact the current stable San Juan Forest-wide habitat trend and slightly downward trend for optimal habitat for the 20-year analysis period. Consequently, activities occurring on NFS land are expected to affect mainly individuals and negligibly affect the estimated secure, well-distributed, populations of Abert's squirrels in the Project Area and throughout the SJNF.

J.4.2.3 Brown Trout

J.4.2.3.1 Species Biology and Affected Environment

The brown trout (*Salmo trutta*) is a fish species native to Europe and western Asia. It was introduced into most major drainages of Colorado during the late 1800s (Behnke 2002). It now occurs widely throughout much of the United States and Canada (Beckman 1953) and is common in cold-water habitats of the State of Colorado.

The brown trout is managed as a game fish and may be harvested subject to State fishing regulations. Its selection as an MIS for the SJNF is attributable to its importance as a game species, and to some degree, its potential to respond to management actions. Due to its widespread distribution and abundance, there is no concern about the brown trout's viability as a species (USFWS 2002, CDOW 2002, CNHP 2002, FS 2001).

Brown trout inhabit cold-water streams and lakes. In streams, they prefer deeper, lower-velocity water with adequate cover in the form of submerged rocks, undercut banks, and overhanging vegetation. Typically they tolerate warmer water temperatures than other species of trout. Optimal water temperature for growth and survival is 12 to 19°C. Upper incipient lethal temperature ranges between 22 and 28°C (Frost and Brown 1967, Needham 1969, Alabaster and Lloyd 1980). The species becomes sexually mature during its second to fifth year (Beckman 1953). Spawning occurs during late fall and early winter when water temperatures approach 7°C. As with other trout species, the brown trout requires cool running water and clean spawning gravels to successfully reproduce. Females produce about 10,000 eggs per spawning event.

Fry (young-of-year fish) occupy quiet waters and feed principally on aquatic and terrestrial macroinvertebrates. In addition to macroinvertebrates, adult brown trout prey on other fish species, including other species of trout. They can be considered the top predator for many aquatic ecosystems. The brown trout is known to compete effectively with other species for food and living space. They often outcompete native trout species, to the point of exclusion (Beckman 1953, Behnke 2002).

Starting in 1987, inventory and monitoring of fish populations have been conducted by the CDOW and the FS on perennial streams on the SJNF. To date, 286 streams have been investigated for the presence or absence of fish. Of these, 190 are known to support fish populations. A total of 287 population-density estimates have been calculated at multiple sites over a 17-year period.

Of the 286 streams investigated, brown trout are known to occupy 41 streams. The occupied streams represent a total of 325 miles of riverine habitat. Brown trout are most common in the larger rivers at lower elevations, similar to those in the Project Area. Forest-wide, 133 population density estimates have been calculated for brown trout, representing 24 locations on nine of the 41 occupied streams. Density estimates range from a low of eight fish per mile and one fish per acre (Upper Animas River, 1998) to 995 fish per mile and 175 fish per acre

(Lower Dolores River, 1992). The median density for all samples at all locations is 198 fish per mile and 30 fish per acre.

Brown trout often occupy lower elevations where higher water temperatures and poorer water quality preclude the existence of other trout species (Raleigh et al. 1986). These areas can represent the lower thresholds of suitable habitat for brown trout. Streams in the Project Area fit this description. Abundance of brown trout decreases in a downstream progression in the analysis area (Japhet 2002). Although more tolerant of degraded conditions than many other species of trout, brown trout still require relatively cold and clean water to survive. Seasonally high temperatures, combined with marginal habitat conditions, are factors that most likely limit abundance and distribution of brown trout in the Project Area streams.

Suitable brown trout habitats on NFS, BLM, State, and Southern Ute land are rare within the Project Area. Perennial streams known to be occupied by brown trout are located primarily on private lands. Brown trout are known to occur in all three major rivers (Animas, Pine, Piedra) and one of the major tributaries (Florida River). Brown trout may occur year-round or seasonally in other tributaries, some of which have not been surveyed for the presence of fish. Therefore, for the purposes of this analysis, all perennial streams within the Project Area are assumed to provide suitable habitat that may be occupied by brown trout. Although some migration of fish among connecting streams likely occurs, each perennial stream is treated as if it can support a discrete population of brown trout.

Table J–19 Miles of Perennial Streams in the Project Area that Are Known to Support or May Support Brown Trout

		Miles of Stream					
Stream	Occupied	NFS	BLM	State	S. Ute	Private	Total
Animas River	Yes	0	0	0	0	1.53	1.53
Beaver Creek	Likely	0.16	0	0	0	12.05	12.21
Florida River	Yes	0	0	0	0	7.57	7.57
Piedra River	Yes	0	0	0	2.14	0.37	2.51
Pine River	Yes	0	0	0	0	6.90	6.90
Salt Creek	Likely	0	0.86	0	0	1.00	1.86
Sauls Creek	Unlikely	4.19	0	0	0	1.29	5.48
Stolsteimer Creek	Unlikely	0	0	0	0	1.70	1.70
Total		4.35	0.86	0	2.14	32.41	39.76

Two Project Area streams, the Piedra River and the Florida River, have minimum instream-flow requirements, intended to protect the fisheries from being impacted by some existing, and all new water uses. These requirements are in the form of instream-flow water rights held by the Colorado Water Conservation Board (CWCB). The rights are for 70 cubic feet per second (cfs) from March 1 through August 31, and 40 cfs from September 1 through February 28, on the Piedra River; and for 20 cfs from October 15 through June 30, and 12 cfs from July 1 through October 16, on the Florida River. Appropriation dates of these rights are March 16, 1978, and January 19, 1977, respectively. New water rights

that might be acquired as part of CBM development would likely be junior to the CWCB claims.

Most existing consumptive uses on these two streams have priority over the non-consumptive CWCB instream flow rights. This renders the CWCB instream flow claims on the Florida River ineffective. During high-use periods, all surface flows may be diverted, leaving sections of stream dewatered. For some of these impacted areas, a small amount of aquatic habitat is maintained by groundwater inflow and return flow from diversions.

Piedra River flows have not been fully appropriated for use. Therefore, CWCB instream flow claims may afford some protection to brown trout. This assumes flow levels are monitored and that the CWCB claims are effectively administered.

J.4.2.3.2 Direct and Indirect Effects

Potential effects on resident populations of brown trout fall into two categories: those related to surface water depletions (water quantity) and those related to erosion, sedimentation, and the possible introduction of pollutants (water quality). Also considered was the possibility of changes to physical habitat (stream structure). This was not evaluated in detail since project roads and utility corridors would not be constructed across perennial streams.

Water Quantity

Decreased stream flows can affect aquatic habitats by reducing the quantity and quality of suitable habitat, and altering water temperature regimes (Meehan et al. 1977, Marcus et al. 1990). The abundance and distribution of brown trout within the Project Area likely are determined by the amount of stream flow and by related water temperature dynamics. For the perennial streams within the Project Area, water temperatures increase, and brown trout densities decreases, in a downstream progression (Japhet 2003). For average precipitation years, the influence of any significant flow reductions on brown trout populations would be greatest during fall and winter, when natural flows are at their lowest and physical habitat can be limiting. During drought years, the effects would be greatest during summer months when the combination of high water temperatures and low flows can exceed lethal temperature thresholds.

Coal bed methane development would likely reduce flows in perennial streams both within and downstream of the Project Area. The dewatering of coal seams would reduce groundwater discharge to streams, and increase surface water interception and infiltration (Sections 3.4, 3.5). Surface flow reductions are not expected to differ significantly by alternative. Any threat to aquatic resources and brown trout populations as a result of water depletion is similar for all action alternatives.

When combined, the depletions of surface flows resulting from the pumping of groundwater, and from the use of surface flows for drilling, deplete approximately 216 acre-feet per year (Section 3.5). This analysis assumes the volume is depleted at a constant rate within any given year. Table J–20 provides a comparison of predicted flow depletions with mean wintertime base flows for each major

stream. Discharge rates correspond to the nearest U.S. Geological Survey (USGS) gage locations upstream from the Project Area.

Table J–20 Changes in Mean January flow Rates Resulting from CBM Development

Stream	Mean January Flow Rates (cfs)	CBM Depletion (cfs)	Change (percent)
Animas River (1898–1999)	203.2	0.10	0.05
Florida River (1917–1960)	10.1	0.02	0.20
Pine River (1928–1986)	61.6	0.10	0.16
Piedra River (1940–1973)	56.5	0.09	0.16

A variety of historic and ongoing water uses have had, and will continue to have, significant impacts on the above streams. While the greatest volume of depletions occur during the months of May through July, when supplies and demands are highest, other uses continue year-round when supplies are relatively low. The percent change in flows shown in Table J-20 are for the month of January and are applicable to the low flow winter months when habitats are typically most limited and CBM depletions could have the greatest relative impact. For the month of January, the predicted changes in base flows are limited to two tenths of one percent, or less. These volumes are insignificant when considered individually. However, it should be understood that stream flows and water temperatures are primary limiting factors for trout populations occupying Project Area streams. As such, any depletion will contribute to the overall cumulative effect of the many ongoing water uses, both within and downstream from the Project Area.

It is also possible that the greatest effect of CBM development to the Florida River would not be during winter periods, but instead would coincide with the high-use irrigation season. As previously described, the Florida River is over appropriated and sections of stream can be totally dewatered during high-use periods. During these times, localized groundwater inflow helps sustain low levels of aquatic habitat in otherwise dewatered reaches. It is possible that CBM development, which has the potential to reduce the groundwater sources, may ultimately eliminate these types of habitat.

Water Quality

The quality of surface waters can also be affected by CBM development. The potential exists for the introduction of contaminants such as polycyclic aromatic hydrocarbons (PAHs) to streams, mainly from accidental oil spills. Spills of highly saline, produced water are also possible. The effects of such contaminations would likely be short-term, but could have significant impacts on aquatic biota. Although spills of this nature have occurred with previous CBM development, the probability of such spills cannot be predicted and the potential effects cannot be quantified.

Of greater concern to local fisheries is the construction of well pads, utility corridors, and roads, (surface disturbances). Roads are known to increase erosion rates and sediment loads in streams (Cline et al. 1983, Fredriksen 1970, Krammes and Burns 1973, Yee and Roelofs 1980). They not only mobilize sediment through

ground disturbance, but also act as conduits that transport sediment to stream channels. High sediment levels effect salmonids by reducing respiration and ion exchange rates across gills, filling interstitial spaces in stream gravels needed for successful reproduction and for macroinvertebrate production, impairing feeding efficiency, increasing solar-energy absorption and increasing water temperatures, and increasing channel scour, resulting in altered habitat characteristics.

Levels of surface disturbances differ by alternative. Table J–21 compares the alternatives, describing the relative risks to water quality and brown trout habitats from increased sediment production and delivery to streams.

Table J–21 Sedimentation Risk Index; a Relative Comparison of Surface Disturbances as Related to Sediment Production

Alternative	Acres Disturbed	Miles of New Road	Crossings[1]	Score[2]	Rank
1	1,039	100	173	615	2
1A	809	74	128	459	3
1B	728	57	99	364	6
2	1,736	177	306	1,079	1
3	680	61	106	380	5
4	692	75	130	453	4
5	376	31	54	196	7

Notes:
1. "Crossings" estimate new road intersections with intermittent drainages
2. Scores are weighted to reflect relative importance of metrics. (Rank of 1 = greatest risk; 7 = lowest risk.)

The actual amount of soil loss and corresponding increases in sediment input to streams are difficult to predict and will change over time. Areas disturbed for utility lines would be restored immediately after construction, and some roads would be restored when the project is eventually abandoned, reducing sediment inputs. Some level of impact will persist indefinitely, however, and surface disturbances and related impacts to water quality should be considered long-term effects.

Implementation of watershed mitigation measures (BMPs) discussed in Section 3.1.4 (*Mitigation and Monitoring*), Section 3.6 (*Surface Water Resources*), and Section 3.7 (*Soils*) is designed to reduce sediment inputs to surface waters. The magnitude and duration of sediment impacts will depend on the long-term effectiveness of these sediment controls. If BMPs are properly implemented, monitored, and maintained, the effects of CBM-related sedimentation on brown trout populations should be minimized.

J.4.2.3.3 Cumulative Effects

The most influential off-site effects to brown trout populations originate upstream of the Project Area. In addition, the occurrence of brown trout is rare downstream of the Project Area. Therefore, the analysis area selected for addressing cumulative effects to brown trout is the Project Area and the portions of the Animas, Pine, and Piedra watersheds occurring upstream of the Project Area.

Water Quantity

The water depletions associated with the proposed action (216 acre-feet per year) are small, relative to the total depletions occurring within the basin. Over 3,000 water right adjudications have occurred within the Animas, Pine, and Piedra watersheds, representing over 130 years of consumptive uses. These uses have had significant impacts to local streams, especially in the most downstream sections where agricultural uses are greatest and depletions are compounded.

Given the small amount of NFS stream habitats affected (4.35 miles), and the small amount of water depleted by this action, the risks to SJNF fishery resources are minor. Throughout the Project Area, the predicted decreases in stream flows are not likely, by themselves, to cause increased fish mortality. However, water on several of the affected streams is already over appropriated. With local population growth, new water appropriations will occur on all affected streams. The effects of water development to aquatic habitats and associated salmonid fish populations on the SJNF is generally known. Reductions in the quantity and quality of aquatic habitats, resulting from water development, has led to a decrease in fish production. When ongoing and future water depletions within and upstream of the Project Area are considered collectively, stream habitats and brown trout populations are at some risk.

Water Quality

Cumulative effects to water quality include past and ongoing oil and gas development on lands within the Cumulative Effects Analysis Area, and proposed oil and gas development within the Project Area. Under maximum project development, 522 new wells would be added to the 294 existing wells within the Project Area. What is not known is the level of future CBM development that might occur within the Cumulative Effects Analysis Area north of the Project Area. Some new development will likely occur, but should be minimal due to the lack of CBM-producing geologic formations north of the Project Area.

Other impacts to water quality include mining, road construction, urbanization, grazing, and agricultural development, all of which have contributed to degraded water quality in the affected watersheds. There is little question that these impacts have affected and will continue to affect local fisheries, including brown trout populations. The proposed CBM development will, to some degree, contribute to the ongoing cumulative effects to water quality.

J.4.2.3.4 Relationship of Project Effects to Forest-wide Population and Habitat Trends

As previously described, 286 streams on the SJNF have been inventoried to determine the status of fish populations. Brown trout are known to occupy 41 of the 286 streams sampled. The 41 occupied streams represent a total of 325 miles of riverine habitat. Forest-wide, 133 density estimates for brown trout populations have been calculated for 24 locations, including nine of the 41 occupied streams. Estimates range from a low of eight fish per mile and one fish per acre (Upper Animas River, 1998) to 995 fish per mile and 175 fish per acre (Lower Dolores River, 1992). The median density for all samples at all locations is 198 fish per mile and 30 fish per acre.

High levels of statistical variation are not uncommon when estimating densities of biological populations (Ricker 1975), a consideration that should be acknowledged when interpreting population trend data. Ninety-five percent confidence intervals have been calculated for each of the 133 brown trout density estimates considered for this analysis. For many samples, high levels of statistical variation occur. As a result, brown trout population trends can be determined with confidence for six sites associated with two of the nine streams sampled. The results from the other seven streams must be considered inconclusive and are not analyzed further.

While for seven streams population trends cannot be stated with a high level of statistical confidence, the locations where trends have been well described provide insight concerning the effects of water depletions to local brown trout populations. These analyses show declining population trends correlated with reduced flows and increased water temperatures. These results agree with the results of numerous scientific peer-reviewed studies that have evaluated the cause and effect relationships between stream flows, aquatic habitats, and fish population response. In addition, it requires only common sense to reason that reductions in stream flows will result in reductions in aquatic habitats, which in turn will typically lead to reductions in aquatic organisms that rely on these habitats. Given this, it is reasonable to conclude that brown trout and other fish populations have declined from historic levels across the SJNF as a result of incremental water development occurring over the last 130 years.

More recently, it is likely that fish populations have been further reduced by the severe drought conditions experienced from 2000 through 2003. As an example, the combined stress of reduced stream flows, high temperatures, poor water quality, and resulting marginal habitat conditions, increased mortality in the lower Dolores River to the point that only 13 percent of the pre-drought brown trout population now exists. In other streams, like the lower Florida River, stream flows were reduced to zero, virtually eliminating suitable habitat and any dependent aquatic populations. In addition, water temperature limits were probably exceeded in some sections of the occupied streams, contributing to what is expected to be a downward trend in brown trout populations Forest-wide.

Of the miles of stream potentially occupied by brown trout within the Project Area, only 0.16 miles occur on National Forest System lands. That is a small section of Beaver Creek, which is a tributary to the Los Pinos (Pine) River. Beaver Creek is a 4th order perennial steam with a total length of 22.4 miles, 16.5 of which are located on NFS land. Three hundred feet (0.06 miles) of Beaver Creek were surveyed by the CDOW in 1984. The sampling location was on NFS land just north of the Project Area. Fish species identified were cutthroat trout, white sucker, bluehead sucker, speckled dace, and mottled sculpin. While brown trout were not identified during this sampling, they likely inhabit the lower reaches of Beaver Creek near the confluence with the Pine River, and may occur in some upstream reaches on NFS land.

As previously described, the median value for brown trout density for occupied streams on the SJNF is 198 brown trout per mile. Based on the 1984 survey data for Beaver Creek, which failed to produce any brown trout, it is unlikely that any portion of the stream supports fish density approaching the median Forest-wide

levels. However, assuming the 16.5-mile section of Beaver Creek on National Forest does support median densities, it would be occupied by approximately 3,267 brown trout. Assuming an unlikely catastrophic event (e.g. oil spill or total dewatering) and the loss of 100 percent of the individuals occupying the 0.16-mile portion of the NFS stream that would be affected by CBM development, approximately 32 of the 3,267 brown trout (1 percent) would be eliminated. Such a loss would not have a long-term effect on the Beaver Creek population and would not compromise population viability across NFS lands. However, assuming the unlikely loss of 32 fish, there would be a minor contribution to the overall downward population trend across the SJNF.

J.4.2.4 Elk

The elk analysis is based on the model presented in the elk chapter of the SJNF MIS assessment.

J.4.2.4.1 Species Biology and Affected Environment

Towry (1984) describes elk (*Cervus elaphus*) as having three broad habitat requirements: (1) feeding, (2) cover, and (3) rearing. Elk habitat on the SJNF provide for these requirements. Feeding and cover requirements are important year-round on summer and winter ranges. Rearing requirements are important for a brief period in the spring on summer range.

Elk tend to inhabit higher elevations during spring and summer and migrate to lower elevations for winter range. Some elk herds, however, are relatively sedentary. Most of the elk on the SJNF migrate over great distances between summer and winter range, but there are a few "resident" herds of about 40 or more animals each on the SJNF that remain in a relatively small area. Migrating elk typically follow the melting snow pack upslope in spring; fall migrations are tied to weather and forage availability. Snow depth of about 16 inches triggers elk movement to winter ranges. Although they can move through snow more than 3 feet deep, this condition forces the animals to plow through snow in single file and change leaders as they tire. During winter, elk form large, mixed herds on favored winter range.

Calving grounds are carefully selected by the cows and are generally where cover, forage, and water are in juxtaposition. In western Colorado, most females calve within 200 yards of water (Seidel 1977). Females with calves isolate themselves from the herd for the first two to three weeks. Once the calves are large enough, females with young rejoin the herd.

Elk are both grazers and browsers. In the northern and central Rocky Mountains, grasses and shrubs comprise most of the winter diet, with the former becoming more important in the spring months (Kufeld 1973). Forbs become increasingly important in late spring and summer, and grasses again dominate their diet in the fall. Forbs tend to be favored on drier sites, but browse is preferred in most mesic areas, including aspen stands, willow communities, and moist meadows.

The Project Area supports a resident herd of about 150 animals and is winter range for a large number of migrating elk (Carron 2003). Elk funnel into and through the HD Mountains from the high country north of U.S. Highway 160.

Major north-to-south fall migration corridors occur (1) down Beaver Creek, into and through the Klondike Park area, and (2) into the Piedra River bottom, from east of the river and north of Chimney Rock. Some of these elk continue migrating east of the HD Mountains divide along the Piedra River to irrigated, fertilized hayfields near Arboles.

There is also a general movement into lower elevations on each side of the HD Mountains by resident and migratory elk. The west slope of the mountains supports more extensively used winter range than the east slope. The western slope contains open canyons, more open habitat, small lower-elevation parks, and irrigated, fertilized agricultural land. Winter big-game use of this private agricultural land is becoming a conflict on select ranches. The HD Mountains and areas in the western portion of the Project Area are important elk wintering areas that annually support moderate to heavy use.

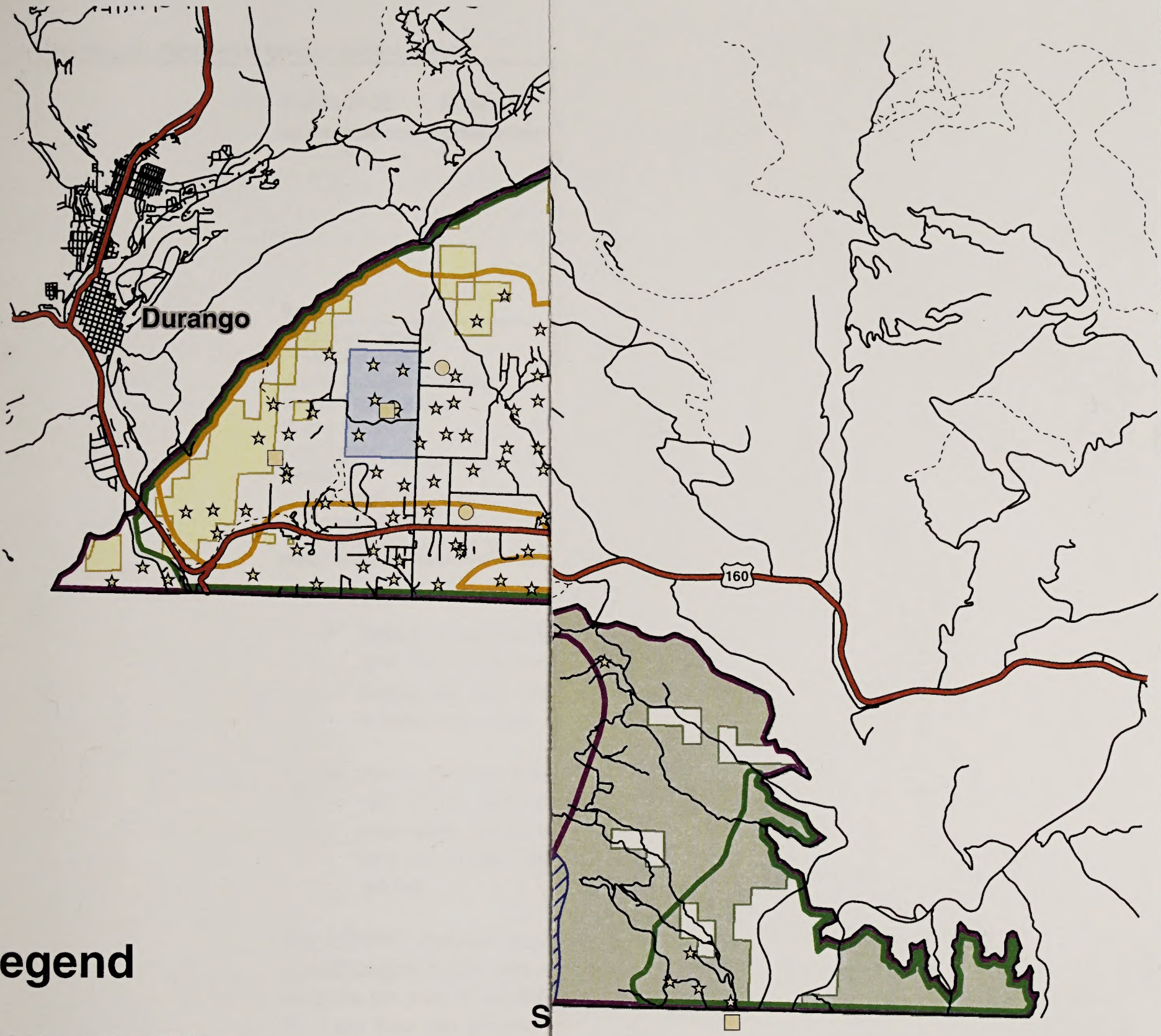
Past development (both oil/gas and human) on the west side of the Project Area has been significant, compared with the east side. There are no specific studies regarding migration corridors available for the Project Area (this lack of data was confirmed by references that include Garcia 2002, Hayden 2002, Wait 2002, Carron 2002, Kloster 2002). However, Carron (2002) has not noticed any CBM development effects on migration corridors in the Project Area by to date.

Spring migration from the Project Area to higher elevations and to the north generally reverses fall patterns. Some elk migrating north from the Arboles area probably remain in the HD Mountains, while others move up both sides of the Piedra River to summer ranges north of U.S. Highway 160. Bulls generally move directly to summer ranges, whereas cows and yearlings move to calving grounds at the lower elevations of their summer range. Specific calving grounds of the Pargin Mountain herd have been identified and delineated by CDOW. Historically (pre-European settlement), summer range probably encompassed the entire Project Area. Current distribution of elk during the summer is mostly limited to upper elevations (more than 8,000 feet) on NFS land.

The CDOW has defined a set of ranges for big game, including Production Area, Winter Range, Winter Concentration Area, and Severe-Winter Range (CDOW 1997a; CDOW 1997b; CNDIS 2001a). The types and distribution of elk ranges in the Project Area and Cumulative Effects Analysis Area are presented on Figure J–1 and in Table J–22. These ranges are defined as follows:

- Production Area: That part of the overall range of a big-game species occupied by the females from May 15 to June 15 for fawning/calving. (Only known areas are mapped, and this does not include all production areas for the Data Analysis Unit [DAU].)

- Winter Range: That part of the overall range of a species where 90 percent of the individuals are located during an average of five winters out of ten, from the first heavy snowfall to spring green-up, or during a site-specific period of winter, as defined for each DAU.



Legend

Existing Facilities

- Compressor
- Disposal Well
- Fruitland Well
- Non-Fruitland Well

Existing Roads

- Highway
- Secondary
- Trail Open to Motorized Use

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NORTHERN SAN JUAN BASIN CBM EIS

FIGURE J-1
ELK RANGES

ANALYSIS AREA: LA PLATA & ARCHULETA COUNTIES, COLORADO	
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	Drawn By: MSH

Major north-to-south fall migration corridors occur (1) down Beaver Creek, into and through the Klondike Park area, and (2) into the Piedra River bottom, from east of the river and north of Chimney Rock. Some of these elk continue migrating east of the HD Mountains divide along the Piedra River to irrigated, fertilized hayfields near Arboles.

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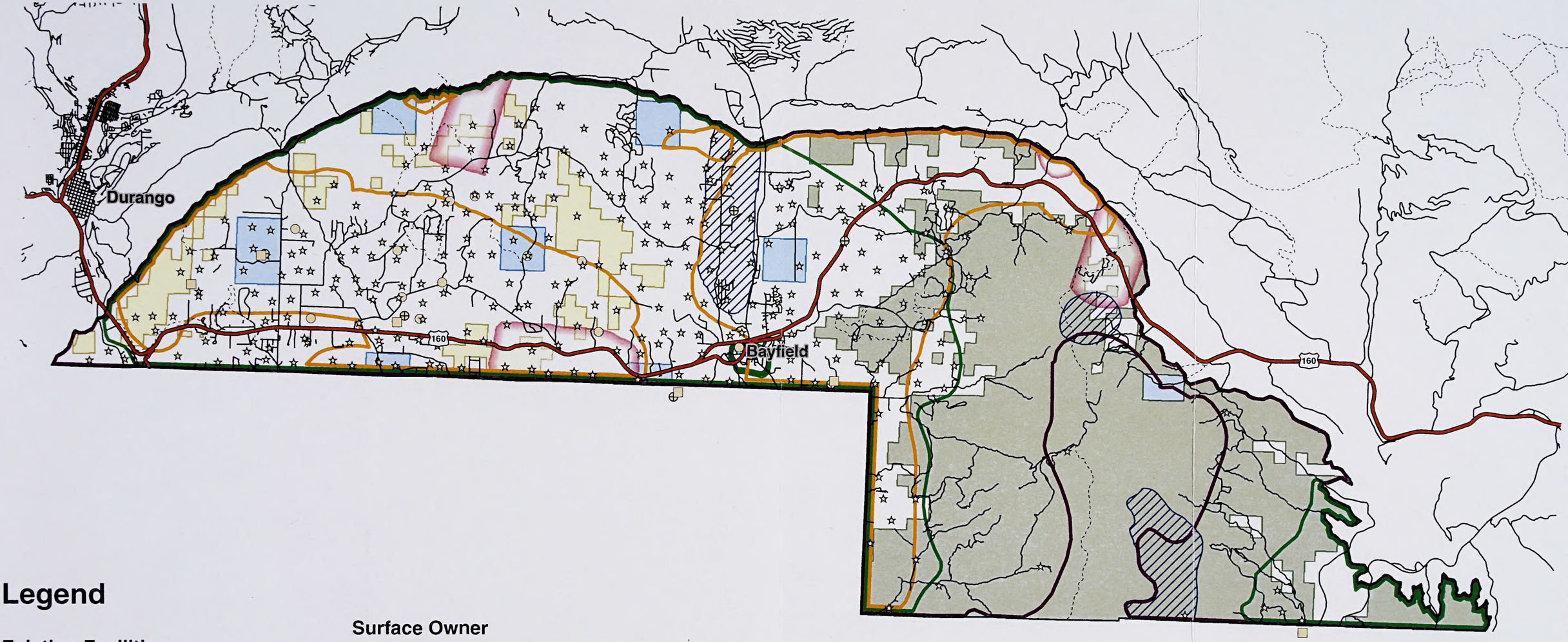
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Legend

Existing Facilities

- Compressor
- Disposal Well
- Fruitland Well
- Non-Fruitland Well

Existing Roads

- Highway
- Secondary
- Trail Open to Motorized Use

Surface Owner

- BLM
- STATE
- USFS

Elk Range

- Migration Corridors
- Production Areas
- Winter Concentration Area
- Winter Range
- Severe Winter Range

N W E S

0 1 2 4 6 8 Miles

0 1 2 4 6 8 10 Kilometers

NORTHERN SAN JUAN BASIN CBM EIS

FIGURE J-1
ELK RANGES

ANALYSIS AREA: LA PLATA & ARCHULETA COUNTIES, COLORADO

Date: 041/01/04	File: I:\994\..\elk_maps.mxd
	Drawn By: MSH

Table J–22 Summary of Elk Habitat Ranges

Range	NFS land (acres)	Portion of NFS land (percent)	Project Area All Ownerships (acres)	Portion of Project Area (percent)	Cumulative-Effects Analysis Area (acres)	Portion of Cumulative-Effects Analysis Area (percent)
Migration Corridor	1,035	2	6,231	5	N/A[1]	-
Production Area	3,014	6	6,233	5	N/A	-
Winter Concentration Area	7,239	15	53,713	43	104,687	19
Severe-Winter Range	9,464	19	77,119	62	235,484	43
Winter Range	38,236	77	113,541	91	504,850	92
Area Extent[2]	49,383	100	125,347	100	546,347	100

Notes:
1. Not Applicable — no summary of migration corridors or production areas from SUIT EIS.
2. Acreage for each level of analysis; NFS land, Project Area, and cumulative effects analysis area (also considered summer range within the Project Area).

- Winter Concentration Area: That part of the winter range where density is at least 200 percent greater than the surrounding winter range density, during the same period used to define Winter Range in the average five winters out of ten.

- Severe-Winter Range: That part of the range of a species where 90 percent of the individuals are located when the annual snow pack is at its maximum and/or temperatures are at a minimum in the two worst winters out of ten. The winter of 1983–1984 is a good example of a severe winter.

The CDOW monitors populations of big-game species by DAUs. A DAU is a specified geographic area where harvest and census data are gathered and used to estimate the size of wildlife populations. Most of the Project Area is in DAU E–31. Less than one percent of the Project Area, on the extreme western end near Durango, is in DAU E–30 and is not considered for this analysis. DAU E–31 encompasses the east half of the SJNF, which is all of the Pagosa Ranger District and the east half of the Columbine Ranger District.

In 2002 the DAU E–31 elk population was estimated to be 27,450 individuals. In that same year it was estimated that 19 percent of that population wintered in the Project Area; over the last six winters that percentage ranged from 5 to 30 percent (Wait 2003). Considering that the Project Area resident herd of 150 also wintered in the same area, the 2002 winter population in the Project Area would have been about 5,640 individuals.

Elk have no listing status with the USFWS. The Forest Plan identifies elk as an early-successional MIS, and CDOW manages elk as a big-game species.

The elk was selected as an MIS because it is a habitat generalist, potentially using all habitats in the Project Area. A substantial proportion of the Project Area is designated elk winter range, winter concentration area, severe-winter range, and

production area. Elk are highly susceptible to disturbance from human activity along roads, and will decrease use of habitats near roads as traffic increases.

The effects of the proposed project on elk, in terms of direct habitat loss, reduction of habitat effectiveness, human disturbance, and increases in mortality, are of concern.

Elk populations on the SJNF rose steadily from 33,753 to a high of 44,496 in 1992, then fell to 27,448 in 2002 (Wait 2002). Elk population viability is considered secure and current population size slightly above the CDOW population objective (Wait 2002).

A comparison of trends in forage-to-cover ratios and elk populations on the SJNF does not suggest an interrelationship on summer range. From 1983 to 1992, the ratio was departing from the optimum of 60:40, while the population climbed from 33,753 to 44,596. From 1992 to 2002, the ratio was stable; the population fell from 44,596 to 27,448. These data strongly suggest that other factors, such as weather and hunter success, have had a greater influence on elk populations than have habitat impacts.

J.4.2.4.2 Direct and Indirect Effects

Direct effects are those attributed to loss of habitat to roads, well pads, and facilities during the initial construction phase. Indirect effects are those associated with a loss of habitat effectiveness due to changes in human access that could behaviorally affect animals during the long-term production phase.

Because elk are habitat generalists, shifts in habitat types normally do not preclude use of an area. For this reason the suitability of elk habitat is measured in the amount of forage relative to the amount of cover in a given range type (i.e. winter range). As defined by Thomas (1979) "optimum deer and elk habitat is the amount and arrangement of cover and forage areas that result in the maximum possible proper use of the maximum possible area by the animals." In the Blue Mountains of Oregon a ratio of 60-percent forage to 40-percent cover is optimum. This ratio has been widely adopted in many forested elk habitats across western states. Table J–23 displays current forage to cover ratio on NFS lands and those that would result from each alternative. Forage and cover information is not available on other ownerships in the Project Area.

Table J–23 Forage to Cover Ratios by Range Type for Each Alternative on NFS Land

	Existing Forage to Cover Ratio	Cumulative Effects						
		Alt. 1	Alt. 1A	Alt. 1B	Alt. 2	Alt. 3	Alt. 4	Alt. 5
Winter Concentration Area	64:36	65:35	65:35	64:36	66:34	65:35	65:35	65:35
Severe Winter Range	61:39	62:38	62:38	61:39	63:37	62:38	62:38	62:38
Winter Range	62:38	63:37	62:38	62:38	63:37	62:38	62:38	62:38
Migration Corridor	86:14	87:13	86:14	86:14	87:13	86:14	86:14	86:14
Production Area	45:55	47:53	46:54	45:55	47:53	45:55	46:54	45:55
Summer Range	59:41	60:40	59:41	59:41	60:40	59:41	59:41	59:41

Some loss of habitat due to road, well pad, and facility construction would occur that would create a condition that is neither forage nor cover. This amount of conversion to non-habitat is not significant compared to the amount of cover that could be converted to forage. Therefore, non-habitat is not addressed in this analysis. Road right-of-ways and well pad areas normally provide adequate forage areas if properly seeded. Habitat conversion would be in the form of small rectangular, or square openings at well pads and other facilities, and linear openings along road and utility corridors.

Existing ratios for all ranges are near optimum of 60 percent forage to 40 percent cover except for migration corridors and production areas. Migration corridors are heavily skewed towards forage. Factors other than forage to cover ratios may be more important in these areas. The openness in these corridors indicates an extended line of sight; therefore consideration to road, well pad, and facility placement should be paramount. Production areas contain more cover than forage, which is expected for the needs of security during calving.

For most alternatives there is a slight decrease in cover that moves the ratio away from the index of optimum in all range types. This shift is most evident in Alternative 2 where cover decreases by about 2 percent. Under Alternative 5 the change in forage to cover is nearly immeasurable. Alternatives 1, 1A, 1B, 3, and 4 would result in similar slight decreases in cover.

Vehicular use of roads adversely affects elk use of adjacent habitats (Burbridge and Neff 1976; Hershey and Leege 1976; Leege 1976; Marcum 1976; Perry and Overly 1976; Ward 1975; Ward et al.1976; Hinschberger et al. 1978; Lyon 1979; Rost and Bailey 1979; and Johnson and Lockman 1981; Johnson et al. 1990). Reduced habitat effectiveness (Lyon 1979) is the degree to which habitat adjacent to roads or human activity areas are less than fully utilized because animals are avoiding the associated activities. The zone of disturbance adjacent to roads that is avoided by elk is up to 1.8 miles, depending on the type and use of roads and the adjacent habitat. This zone is not completely abandoned by elk, but the effective use of this area is reduced depending on a number of factors. Greater traffic volume on paved roads through more open habitats generally produces a wider zone of avoidance (Perry and Overly 1976; Hershey and Leege 1976; and Rost and Bailey 1979).

Road access on NFS Project lands is currently managed for summer/fall recreational use and winter big-game range. During summer there is a higher effective road density than winter. The general hunting season occurs during this summer/fall season and the greatest human disturbance occurs at this time. During winter most NFS roads are gated and access is granted to industry maintenance personnel only. Any newly constructed road would be gated year-round and would receive only industry-associated activities.

Table J–24 lists current road and motorized trail densities and densities that would result from each alternative. The road densities represent year round conditions except for NFS lands, where roads are open or closed depending upon time of year. Roads that sustain any authorized use were included in density calculations.

Table J–24 Road and Motorized Trail Densities in the Project Area

Range, Elk Habitat	NFS	BLM	State	Private	Total
Existing Condition					
Winter Concentration Area	0.7	0.5	1.5	2.2	2.1
Severe Winter Range	0.6	0.4	1.3	2.1	1.9
Winter Range	0.2	0.4	1.4	2.1	1.9
Migration Corridor	2.4	0.7	2.2	1.6	1.5
Production Area	0.1	0.0	0.0	2.4	1.3
Summer Range	1.5	0.4	1.4	2.2	1.8
Alternative 1					
Winter Concentration Area	1.7	0.7	1.5	2.4	2.3
Severe Winter Range	2.3	0.7	1.3	2.4	2.3
Winter Range	1.7	0.7	1.4	2.4	2.3
Migration Corridor	3.2	0.9	2.2	1.8	1.9
Production Area	2.7	0.0	0.0	2.7	2.7
Summer Range	2.5	0.7	1.4	2.4	2.3
Alternative 1A					
Winter Concentration Area	1.3	0.7	1.5	2.4	2.3
Severe Winter Range	1.7	0.7	1.3	2.4	2.2
Winter Range	1.2	0.7	1.4	2.4	2.2
Migration Corridor	2.9	0.9	2.2	1.8	1.8
Production Area	2.0	0.0	0.0	2.8	2.4
Summer Range	2.1	0.7	1.4	2.4	2.2
Alternative 1B					
Winter Concentration Area	1.7	0.7	1.5	2.4	2.3
Severe Winter Range	1.8	0.7	1.3	2.4	2.2
Winter Range	1.2	0.7	1.4	2.3	2.1
Migration Corridor	2.6	0.9	2.2	1.8	1.8
Production Area	1.2	0.0	0.0	2.7	2.0
Summer Range	1.9	0.7	1.4	2.4	2.1
Alternative 2					
Winter Concentration Area	3.4	1.1	1.5	2.6	2.5
Severe Winter Range	3.3	1.0	1.6	2.6	2.5
Winter Range	3.4	1.0	1.7	2.6	2.8
Migration Corridor	5.0	0.9	2.2	2.2	2.4
Production Area	2.8	0.0	0.0	2.8	2.8
Summer Range	3.2	1.0	1.7	2.7	2.7
Alternative 3					
Winter Concentration Area	1.7	0.7	1.5	2.4	2.3
Severe Winter Range	2.4	0.7	1.3	2.4	2.3
Winter Range	1.4	0.7	1.4	2.4	2.2
Migration Corridor	2.7	0.9	2.2	1.8	1.8
Production Area	0.2	0.0	0.0	2.8	1.5
Summer Range	2.0	0.7	1.4	2.4	2.1
Alternative 4					
Winter Concentration Area	1.4	0.7	1.5	2.4	2.3
Severe Winter Range	1.5	0.7	1.3	2.4	2.2
Winter Range	1.3	0.7	1.4	2.3	2.2
Migration Corridor	2.7	0.9	2.2	1.8	1.8
Production Area	2.0	0.0	0.0	2.8	2.4
Summer Range	2.1	0.7	1.4	2.4	2.2
Alternative 5					
Winter Concentration Area	1.1	0.7	1.5	2.4	2.3
Severe Winter Range	1.1	0.7	1.3	2.4	2.1
Winter Range	0.6	0.7	1.4	2.3	2.0
Migration Corridor	2.4	0.9	2.2	1.8	1.7
Production Area	0.1	0.0	0.0	2.7	1.5
Summer Range	1.6	0.7	1.4	2.4	1.9

Winter ranges on NFS land have various management area designations including; 2B, 3A, 4B, 5B, and 6B. In general, Forest Plan guidelines for these areas specify an open road density no greater than one mile of road per one square mile of land. Existing summer range road densities on NFS land are at 1.5 miles/square mile; Alternative 2 would increase densities by about 2-miles/square mile. Alternatives 1, 1A, 1B, 3, and 4 would increase road density by about 0.5 mile/square mile. Winter concentration area, severe winter range, and winter range road densities are listed in Table J–24 for NFS lands.

Migration corridors have high road density for all ownerships. Part of this is a function of the relatively small area of the corridors where road crossings are magnified.

BLM and state owned lands within the Project Area are gated year-round with road access granted only to industry. Existing winter range road densities are relatively low, 0.4 miles/square mile and 1.4 miles/square mile respectively. There would be a small increase in road density from existing conditions for each alternative. The largest increase would result from Alternative 2.

Habitat management guidelines for northern Idaho predict 10 to 70 percent reductions in elk use within 0.25 miles of open roads (Interagency Study Team 1977). Avoidance is reinforced by unpleasant experiences during the hunting seasons (Geist 1970) and by the perceived threat from vehicles and humans outside the hunting seasons. One-quarter mile is the distance most commonly used to assess the influence of open secondary roads on elk habitat effectiveness. This zone of disturbance may be narrower for gas development access roads since they may be closed to the public (Perry and Overly 1976), and are infrequently used (e.g., once per day). Elk show little or no avoidance of roads completely closed to vehicular traffic (Marcum 1976). The above zones of disturbance were developed based on displacement from individual roads. Closing gravel roads to the public through big game winter ranges can reduce adjacent zones of disturbance and increase habitat effectiveness. Use of remote telemetry to monitor wells can further reduce CBM industry traffic and maintain habitat effectiveness.

Elk tolerance/avoidance of human developments and activities also varies widely between seasonal ranges based on a variety of factors such as habitat availability and juxtaposition, importance of the habitat, animal condition, winter severity, and the suitability and availability of adjacent habitats. Avoidance zones are generally narrower during winter because winter ranges are aerially restricted and there are few adjacent areas to move to even if the animals could energetically afford to do so. Avoidance zones are generally narrower at the end of the winter, and narrower during severe winters than during mild winters (i.e., if elk are starving, they will approach human developments and activities more closely to forage).

For this analysis, habitat effectiveness was measured by assuming a zone of disturbance adjacent to roads and facilities. In general, a 0.25-mile zone of disturbance buffer was applied to all existing and proposed roads and facilities. Habitat loss within this buffer was adjusted to reflect the various levels of disturbance attributed to vehicle access. Roads and facilities were assigned 10 percent,

40 percent, or 70 percent reductions in elk use within the impact zone and then summarized by acreages for each range type for each alternative (Table J–25).

The existing winter range is currently near optimum conditions; the alternative would introduce a reduction in winter range habitat effectiveness during the production phase. Construction impacts would be limited to summer/fall and would not affect wintering elk. On NFS lands the most notable effects of the alternatives would occur on winter range. The alternatives would reduce habitat effectiveness by 0.9 percent to 4.0 to 8.0 percent of current capacity (Table J–25).

On non-NFS lands there has been a significant reduction in elk habitat effectiveness, about 50 percent using the same modeling assumptions. Private land has contributed most to this loss. Proposed CBM development on non-NFS lands is similar for all alternatives and would further reduce the effective habitat to about 40 percent of capacity (Table J–25).

Harassment that results from activity at a well pad is short-term and is not a major concern for wildlife (Wait 2002). However, the potential for hunting pressure and wildlife harassment to increase is greater as the number of roads and subsequent human activity in an area increases. When CBM roads are built on public lands, hunters and other recreationists have improved access (Hayden 2002, Carron 2002). Access on private lands is generally much more limited, and hunting pressure and wildlife harassment is not as severe. Alternatives 1 through 4 may increase hunting pressure due to the increased ease of access throughout most of the project area presented by an expanded road system. However, road use would be restricted to foot and horseback, on most roads constructed for CBM development. Assuming continued use of much of the HD Mountains on foot and horseback, the impact to elk would be moderate and long term (Table J–26).

Besides potential changes in habitat effectiveness, elk may experience injury or mortality. There would be potential for the frequency of vehicle collisions with elk to increase in the Project Area because of increased vehicle traffic. However, because many of constructed roads would not be designed for high-speed use, the frequency of vehicle collisions with elk is not expected to noticeably increase. The impact would be moderate and long term ((Table J–26).

J.4.2.4.3 Cumulative Effects

The cumulative effects area includes the Project Area and the west half of the Southern Ute Indian Reservation. The quantitative analysis is restricted to analysis of past, current and future oil and gas development impacts to the Project Area and lands within the bounds of the Southern Ute Reservation. There have been and would continue to be habitat lost to residential and commercial development, but that component of cumulative impact is qualitatively addressed, but not quantified, due to lack of applicable studies.

Table J–25 Elk Habitat Effectiveness

Range Type, Elk Habitat	Effective Habitat Loss Due to Roads, Well Pads and Facilities Winter & Summer (Hunting) Season			
	NFS Lands (acres)	Loss on NFS Lands (percent)	Non-NFS Lands (acres)	Loss on Non-NFS Lands (percent)
Existing Condition				
Winter Concentration Area	176	2.4	27,006	58
Severe Winter Range	226	2.4	36,635	54
Winter Range	325	0.9	41,449	55
Migration Corridor	110	10.6	2,731	53
Production Area	107	3.5	2,112	66
Summer Range	8,905	18.0	41,565	55
Alternative 1				
Winter Concentration Area	340	4.7	28,237	61
Severe Winter Range	620	6.6	38,877	57
Winter Range	1,957	5.1	43,862	58
Migration Corridor	119	11.5	2,840	55
Production Area	326	10.8	2,194	68
Summer Range	9,938	20.1	44,161	58
Alternative 1A				
Winter Concentration Area	263	3.6	28,345	61
Severe Winter Range	508	5.4	39,015	58
Winter Range	1,653	4.3	44,001	58
Migration Corridor	118	11.4	2,863	55
Production Area	307	10.2	2,194	68
Summer Range	9,701	19.6	44,299	58
Alternative 1B				
Winter Concentration Area	340	4.7	28,345	61
Severe Winter Range	502	5.3	39,015	58
Winter Range	1,546	4.0	43,910	58
Migration Corridor	112	10.8	2,863	55
Production Area	249	8.3	2,164	67
Summer Range	9,387	19.0	44,124	58
Alternative 2				
Winter Concentration Area	451	6.2	30,168	65
Severe Winter Range	681	7.2	42,121	62
Winter Range	3,069	8.0	48,183	64
Migration Corridor	112	10.8	3,270	63
Production Area	329	10.9	2,238	70
Summer Range	10,370	21.0	48,529	64
Alternative 3				
Winter Concentration Area	341	4.7	28,345	61
Severe Winter Range	620	6.5	39,018	58
Winter Range	1,604	4.2	44,003	58
Migration Corridor	121	11.7	2,864	55
Production Area	109	3.6	2,194	68
Summer Range	9,211	18.7	44,302	58
Alternative 4				
Winter Concentration Area	305	4.2	28,341	61
Severe Winter Range	462	4.9	39,016	58
Winter Range	1,927	5.0	44,132	59
Migration Corridor	114	11.0	2,864	55
Production Area	291	9.7	2,200	68
Summer Range	9,461	19.2	44,479	59
Alternative 5				
Winter Concentration Area	224	3.1	28,267	61
Severe Winter Range	347	3.7	38,668	57
Winter Range	858	2.2	43,624	58
Migration Corridor	110	10.6	2,856	55
Production Area	107	3.5	2,164	67
Summer Range	8,840	17.9	43,923	58

Table J–26 Comparison of Alternatives by Disturbance Type

Disturbance[1]	Alternative 1	1A	1B	2	3	4	5
Direct habitat loss							
Magnitude and Type of Effect[2]	Minor–	Minor–	Minor–	Minor–	Minor–	Minor–	Minor–
Ranking of Alternatives[3]	6	5	4	7	2	3	1
Habitat fragmentation							
Magnitude and Type of Effect	Minor–	Minor–	Minor–	Minor–	Minor–	Minor–	Minor–
Ranking of Alternatives	6	4	3	7	2	5	1
Avoidance/or displacement (based on road densities and unroaded areas)							
Magnitude and Type of Effect	Mod–	Mod–	Mod–	High–	Mod–	Mod–	Mod–
Ranking of Alternatives	6	4	3	7	2	5	1
Increased vulnerability to vehicle collision							
Magnitude and Type of Effect	Mod–	Mod–	Mod–	Mod–	Mod–	Mod–	Mod–
Ranking of Alternatives	6	3	2	7	4	5	1
Recreation-Hunting pressure/poaching							
Magnitude and Type of Effect	Mod–	Mod–	Mod–	Mod–	Mod–	Mod–	Mod–
Ranking of Alternatives	6	3	2	7	4	5	1
Noise							
Magnitude and Type of Effect	Mod–	Mod–	Mod–	Mod–	Mod–	Mod–	Mod–
Ranking of Alternatives	6	5	4	7	2	3	1
Oil spills/ contaminated reserve pits/increased garbage at facilities							
Magnitude and Type of Effect	Mod–	Mod–	Mod–	Mod–	Mod–	Mod–	Mod–
Ranking of Alternatives	6	5	4	7	2	3	1

Notes:
1. All impacts were assessed based on the assumption that effective mitigation measures would be implemented. Without effective mitigation measures, impacts would likely be greater. These impacts could cumulatively impact populations of elk in the project area and possibly the SJNF.
2. None = immeasurable effect or compensating adverse and beneficial effects, Minor = individuals not likely affected, Mod = (moderate) individuals may be affected but populations would not be affected, "–" = negative effect, "+" = positive effect. Thus, Mod– is a moderate negative effect.
3. Rankings are in order from the least impact (1) to the greatest impact (7).

Within the cumulative effects area, there have been approximately 2,300 CBM and conventional gas wells drilled in the past decade; 2,000 of those are within the boundaries of the Southern Ute Reservation. The level of SUIT CBM development is expected to increase in the near future. The SUIT EIS (BLM et al. 2002) indicates that an additional 1,300 conventional gas, CBM methane, and injection wells would be drilled within the bounds of the Reservation over the 25-year life of the project. A significant portion of non-Forest winter range is located on Southern Ute Indian Reservation land (391,000 acres). The importance of SUIT winter range to deer migrating from the Forest depends on severity of winter snowfall.

The past, present, and reasonably foreseeable cumulative impacts to elk habitats is presented in Table J–27. Existing effects include acres of habitat already impacted by oil and gas development and projected development within the SUIT Reservation. Therefore, cumulative effects for each alternative are the sum of existing effects and the projected effects for that alternative. Estimations of habi-

tat effectiveness for the SUIT portion were taken directly from Table 4.52 of the SUIT FEIS (ibid). The results of the cumulative effects analysis suggests reduced habitat effectiveness on 25 percent of winter range impacted by CBM development. Much of the CBM development is interspersed with residential and rural development, so the two act in combination to reduce elk habitat effectiveness. Further CBM development could reduce habitat effectiveness on approximately 45-percent of elk winter range.

Table J–27 Extent and Proportion of Cumulative Impacts to Elk Habitats from Oil and Gas Development (Area where Habitat Capability is Reduced)

	Existing Effects	Cumulative Effects, by Alternative							Available Habitat
		1	1A	1B	2	3	4	5	
NFS lands									
Winter Conc. Area									
Areal Extent (acres)	284	364	286	364	436	364	335	246	7,239
Portion (percent)	4	5	4	5	6	5	5	3	
Severe Winter Range									
Areal Extent (acres)	317	651	540	533	738	651	483	374	9,464
Portion (percent)	3	7	6	6	8	7	5	4	
Winter Range									
Areal Extent (acres)	465	1,996	1,645	1,574	2,687	1,631	1,869	875	38,236
Portion (percent)	1	5	4	4	7	4	5	2	
Summer Range									
Areal Extent (acres)	465	2,754	2,209	1,965	3,476	1,830	2,145	905	49,383
Portion (percent)	1	6	4	4	7	4	4	2	
Cum. E. Ana. Area[1]									
Winter Conc. Area									
Areal Extent (acres)	35,429	52,509	52,431	52,508	52,581	52,509	52,480	52,390	104,687
Portion (percent)	34	50	50	50	50	50	50	50	
Severe Winter Range									
Areal Extent (acres)	81,443	121,776	121,665	121,659	121,864	121,776	121,609	121,499	235,484
Portion (percent)	35	52	52	52	52	52	52	52	
Winter Range									
Areal Extent (acres)	120,926	221,458	221,106	221,035	222,148	221,093	221,331	220,336	504,850
Portion (percent)	24	44	44	44	44	44	44	44	
Summer Range									
Areal Extent (acres)	70,725	92,414	91,896	91,625	93,136	91,491	91,806	90,656	198,710
Portion (percent)	36	47	46	46	47	46	46	46	

Note:
1. Cum. E. Ana. Area = Cumulative effects analysis area, which consists of the NSJB Project Area and SUIT Study Area.

Other forest management activities that have the potential to influence elk summer and winter range habitat include: timber harvest, livestock grazing, wildfire suppression, prescribed fire, and access management.

Past logging on NFS land has had a minor impact on elk habitat. Most of the past timber harvest has been in the ponderosa pine habitat type where there has been a decrease in canopy closure of mature stands. As a result, there has been a slight

decrease in cover and increase in forage. Impacts on SUIT land are minor, since there are no major commercial sources of timber to harvest.

ATV use has the potential to increase in the Project Area. Effective road closures and enforcement of the ATV loops and other mitigation measures would reduce mortality under the proposed project. Therefore, recreational impacts, specifically hunting, are expected to moderately impact the elk population.

In the western side of the Project Area, increased roading (such as county roads and U.S. Highway 160), agricultural clearings of native species, and residential developments have had a moderate to high impact on elk. Past residential development has caused a far greater loss of sagebrush, mountain shrubs, and other elk habitats than has oil and gas development to date.

Continued residential growth suggests that additional sagebrush and mountain shrub habitats will be lost in the future, further reducing the availability of elk habitats. The increase in residential developments within elk habitats can increase the harassment of elk by domestic animals. Residential development within the cumulative effects analysis area would continue to affect historical elk habitat. Elk and human encounters, particularly vehicle collisions are also increasing within incorporated areas of the cumulative effects analysis area.

J.4.2.4.4 Relationship of Project Effects to Forest-wide Population and Habitat Trends

This section tiers to Forest-wide MIS Assessment, and evaluates how implementation of the proposed project would contribute to elk population and habitat trends across the entire SJNF.

There are currently sufficient habitats available to support a resident herd of 150 elk in the HD Mountain area, and winter range for up to 30 percent of the DAU E–31 population (about 5,500 elk) on NFS lands. Habitats in the Project Area are distributed such that adequate dispersal and species interactions should continue under all alternatives for migrating winter range elk. However, there is concern that the resident herd of 150 animals may be sufficiently disturbed year-round that they leave the area during the summer access season under Alternatives 1 through 4. Public road access mitigation would partially alleviate these concerns. Use of remote telemetry to monitor wells would significantly reduce gas industry traffic during the winter, further protecting the effectiveness of elk habitats during the critical winter period.

CBM construction and production activities occurring on NFS lands that affect migratory wintering elk are not expected to reduce the size of the DAU–E31 population or the greater Forest populations. The project would not compromise current population or long-term population trend across the SJNF. Conversely, hunter success and winter severity would be the most influencing factors affecting elk populations. Public and industry travel restrictions during winter should provide for adequate winter range conditions on the SJNF.

J.4.2.5 Green-Tailed Towhee

The green-tailed towhee analysis tiers to the SJNF's Forest-wide MIS Assessment. Vegetation structural stages are assigned to non-SJNF land in direct proportion to the rates they occur on SJNF land in the Project Area. Habitat structural stage 5 was not assigned for Southern Ute Tribal land included in the cumulative effects area analysis. In this case, acres associated with habitat structural stage 5 were included as part of structural stages 4A, 4B, or 4C. The impact conclusions assume implementation of all project design and mitigation measures described in Section J.3.

J.4.2.5.1 Species Biology and Affected Environment

The green-tailed (*Pipilo chlorurus*) towhee was selected as an MIS because it uses a "unique habitat, habitat that can be monitored." This project uses the green-tailed towhee as an indicator of effects on a variety of species that use Gambel oak, mountain shrub, piñon-juniper, and sagebrush habitats. Species that occur in the Project Area and use these shrubland habitats include common poorwill, dusky flycatcher, western scrub jay, Virginia's warbler, orange-crowned warbler, black-headed grosbeak, spotted towhee, vesper sparrow, and Brewer's sparrow.

The breeding range of the green-tailed towhee extends across most of the western third of the United States Though it is a relatively common Neotropical migratory bird throughout much of its range, it remains one of the more poorly known species of North American birds. Lack of knowledge of this species could be due to its secretive nature and the fact that individuals spend most of their time on or near the ground in thick, shrubby habitats (Dobbs et al. 1998). Towhees forage predominantly on the ground and low in shrubby vegetation, mostly amid dense overhead or surrounding bushes, or at the edge of bushes or thickets. They eat seeds, small insects, and some fruit, such as serviceberry, elderberry, and raspberry (Dobbs et al. 1998).

The green-tailed towhee has no federal or state status (USFWS 2003, CDOW 2002). It has no global or state conservation status (CNHP 2002). It is protected under the Migratory Bird Treaty Act (USDA Animal and Plant Health Inspection Service [APHIS] 2002). The *Partners in Flight* Conservation Priority Scoring process gives it a score of 21 (of a maximum possible score of 35), using the Colorado population trend value from the North American Breeding Bird Survey (BBS), and a score of 21, using the continental population trend value (Colorado Bird Observatory 1997).

BBS green-tailed towhee population trend data show a slight, in-significant decrease since 1966 at the continental (survey-wide) scale and a slight, insignificant increase for the state of Colorado. BBS data for Colorado track towhee population trends at gross geographic scales and long time intervals.

The BBS data appear to represent accurately where towhees are thought to be most abundant in Colorado and the Southern Rockies, and towhee populations appear stable throughout the state of Colorado, including the SJNF. Audubon has coordinated Christmas Bird Counts (CBCs) annually across the United States and Canada since 1900. Survey-wide, the trend in green-tailed towhee detections has

been stable (1959 to 91). Similar to BBS data, CBC data are most appropriately used at large scales and long time intervals, and CBC data also appear to represent where towhees are thought to be most abundant in winter. Given the qualitative agreement between CBC and BBS population trend data, it is reasonable to conclude that green-tailed towhee populations are stable across southwestern Colorado, including the SJNF.

In Colorado, green-tailed towhee breeding range starts at the mountains' edge, with 92 percent of the Colorado Breeding Bird Atlas records west of Longitude 105. In Colorado, towhees are found in the foothills, low mountains, and mesas, and are absent only from the low western valleys and interiors of the intermountain parks where shrubs do not grow (Righter 1998). They are most abundant on the Western Slope, which has more suitable habitat than the Eastern Slope (Andrews and Righter 1992, Righter 1998).

Green-tailed towhee breeding habitat varies with elevation. Breeders prefer species-rich shrub communities in shrub and disturbed and open areas of montane forest, such as those resulting from forest fires (Dobbs et al. 1998). Towhees can be found in thickets, chaparral, shrublands, riparian scrub, and sagebrush, preferring low tree-canopy cover and medium to dense shrub cover. In montane areas, commonly they are found on mountain slopes, plateaus, and higher valleys, associated with dense shrubs 1.6 to 4.9 feet in height on dry, shrubby hillsides and post-disturbance shrubby growth (Dobbs et al. 1998, Knopf et al. 1990).

In Colorado, towhees use Gambel oak, piñon-juniper, sagebrush, pine/oak, aspen/willow, and spruce/aspen habitats (Dobbs et al. 1998, Winternitz 1976). The shrubs most commonly associated with green-tailed towhees are Gambel oak, snowberry, serviceberry, chokecherry, bitterbrush, mountain mahogany, squaw apple, and sagebrush. They avoid dense forests, except in openings where shrubs have developed (Bent 1968, Righter 1998). In Colorado, towhees can be found in shrub habitats all the way to the edge of the tundra (Righter 1998). During the nonbreeding season, they are found primarily in lowland habitats of dense mesquite and dry scrub habitat, along washes in the southwestern U.S. and Mexico (American Ornithologists' Union 1983, Dobbs et al. 1998).

On the SJNF, the green-tailed towhee is a well-distributed and reasonably common breeding species, and winters irregularly (during low-snow years) in lower-elevation canyons and foothill slopes with dense shrublands. During the breeding season, towhees are more abundant on the east and west sides of the SJNF where they inhabit lower-elevation, montane shrublands composed of Gambel oak, riparian scrub, piñon-juniper, and ponderosa pine/oak habitats, interspersed with sagebrush openings. The Forest-wide towhee habitat trend over the last 20 years has remained stable to slightly upward. Colorado Breeding Bird Atlas records show the green-tailed towhee is well distributed continuously across the SJNF and well beyond the SJNF's administrative boundary throughout southwestern Colorado. Therefore, based on the species distribution and habitat maps and field experience, no evidence has been found to suggest that individuals within the SJNF constitute an isolated or unique population for which there is a viability concern.

In the Project Area, large areas of shrublands, sagebrush, and piñon-juniper are suitable breeding habitat for green-tailed towhee. Most Gambel oak is fairly dense, 5 to 15 feet tall, occurs primarily on steep upper slopes above 7,500 feet, and is often mixed with chokecherry, snowberry, and mountain mahogany. Most of the sagebrush on the SJNF portion of the Project Area is fairly open, dominated by grasses and forbs, and occurs at lower elevations on the eastern and western slopes of the HD Mountains; it is most extensive on the west side, extending up into canyons and forming moderate-sized parks. Much of the grassland habitat on nonfederal land in the Project Area was created by clearing sagebrush and piñon-juniper habitats and is used for cattle grazing or hay production.

Surveys for green-tailed towhee were conducted on SJNF land in the Project Area during summer 2003. These surveys targeted areas that the SJNF MIS habitat model predicted were towhee habitat. A total of 1,590 acres on 6 transects was surveyed, and 51 towhees were detected. Using distance estimation techniques (Buckland et al. 1993), towhee density was estimated at 0.132 birds per hectare (0.053 birds per acre).

This density estimate is similar to results from statewide surveys (Leukering et al. 2002). Statewide surveys reported towhee density varying by habitat type from a low of 0.015 birds per hectare, in semidesert shrublands, to a high of 0.167 birds per hectare, in sage shrubland. The only habitat type where statewide density estimates were well outside this range was montane shrubland, with 0.644 birds per hectare. Additional, less formal inventories were conducted in the Pargin Mountain area during June 2003, and green-tailed towhees "were observed during all surveys" in oakbrush-dominated habitats (Clark 2003).

We assume that the primary limiting factor on green-tailed towhee breeding populations on the SJNF is the amount and distribution of breeding habitat, and that all of the habitats described above are breeding habitat in the Project Area.

Acreage of green-tailed towhee habitat was calculated based on the MIS habitat model. This model estimates there is 30,678 acres of towhee habitat on SJNF land in the Project Area, about 62 percent of the SJNF land in the Project Area (Table J–7). There are 75,156 acres of towhee habitat on all land in the Project Area, about 60 percent of the total land base in the Project Area (Table J–8. There are about 232,700 acres of towhee habitat in the SUIT EIS Study Area, to the south of the Project Area, and therefore about 307,856 acres of towhee habitat in the cumulative effects analysis area (Table J–9).

Towhee habitat is well distributed across the Project Area and on all ownerships. In the eastern half of the Project Area, this habitat occurs in larger, more contiguous blocks on SJNF land than on nonfederal land in the western half of the Project Area.

J.4.2.5.2 Direct and Indirect Effects

More research on population limiting factors is needed (Dobbs et. al. 1998). Generally, however, green-tailed towhees require patches of shrub habitat that contain vigorous shrub growth, high shrub species richness, and log cover in order to use a patch for nesting. Patches of healthy shrubs provide concealment and protection for nests and birds (Dobbs et. al. 1998). This species shows a strong

preference for sagebrush habitat, and widespread alteration of sagebrush probably impacts this species, possibly altering the species distribution (ibid). Patches of healthy shrubs provide concealment and protection for nests and birds, but shrub vigor may be more important as a predictor of food productivity (ibid). Any activity, whether it be through active management or natural disturbance, that impacts the shrubland ecosystem may potentially impact the distribution of green-tailed towhees.

Varying amounts of habitats for the green-tailed towhee would be removed under each alternative (Table J–28). Habitat removal at well pad locations would resemble small openings with all vegetation removed. Habitat removal along roads would be in linear openings of varying lengths, averaging 40 feet in width. All vegetation within the 40-foot wide corridor would be removed. Pipelines and utility lines would be placed under or next to roadbeds, buried, then re-contoured and replanted.

Table J–28 Extent and Proportion of Affected Green-tailed Towhee Habitat

	Alternative							Habitat Available (acres)
	1	1A	1B	2	3	4	5	
NFS Land								
Extent (acres)	656	492	476	878	488	518	335	30,678
Portion (percent)	2.1	1.6	1.6	2.9	1.6	1.7	1.1	
Project Area								
Extent (acres)	843	696	659	1,252	675	704	528	75,156
Portion (percent)	1.1	0.9	0.9	1.7	0.9	0.9	0.7	

The extent of the impacts on green-tailed towhee would depend primarily on the number of wells drilled, the length of access roads, and the juxtaposition of infrastructure facilities to green-tailed towhee habitat.

Table J–29 summarizes the magnitude of positive or negative effects on green-tailed towhee, and ranks alternatives from most to least extensive impact. The rankings displayed in Table J–29 are based on the percent of towhee habitat lost under each alternative (Table J–28) and the juxtaposition of towhee habitat to proposed facilities. In general, the amount of habitat lost under all alternatives is relatively small (less than 3 percent), and effects to factors of concern evaluated are moderate. Based on estimates of towhee density and amount of towhee habitat in the Project Area, the alternatives will result in a 0.7 percent to 1.7 percent decline in the Project Area's potential to support towhees. Thus, some individuals may be affected, but none of the alternatives are likely to cause a measurable decline in towhee populations.

Based on direct habitat loss, Alternative 2 would be the most impacting to towhee habitat followed in descending order by Alternatives 1, 1A, 1B, 3, 4, and 5. Alternative 5 would have minor impact on federal jurisdiction across the Project Area.

The estimate of towhee density in the Project Area (0.053 birds per acre) was used to calculate an index of the effect of habitat loss on individual birds. This index is used to compare the effects of implementing the alternatives on individual birds. This index does not represent a population estimate across the entire Project Area, but rather is used to model the potential of towhee habitat to support individual birds. The most extensive alternative (Alternative 2) results in the loss of 1,252 acres of towhee habitat, which has the potential to support 66 towhees. The least extensive alternative (Alternative 5) results in the loss of 528 acres of towhee habitat, which has the potential to support 28 towhees. In contrast, the Project Area has 75,156 acres of towhee habitat, which has the potential to support 3,893 towhees. Thus implementing any of the proposed alternatives will result in a 0.7 percent to 1.7 percent decline in the potential of the Project Area to support towhees.

Table J–29 Relative Impacts on Green-tailed Towhee, by Alternative

Factor	Alternative						
	1	1A	1B	2	3	4	5
Direct habitat loss							
Magnitude and Type of Effects[1]	Mod–	Mod–	Mod–	Mod–	Mod–	Mod–	Mod–
Ranking of Alternatives[2]	6	4.5	4.5	7	2.5	2.5	1
Home range shift and displacement							
Magnitude and Type of Effects	Mod–	Mod–	Mod–	Mod–	Mod–	Mod–	Mod–
Ranking of Alternatives	6	4.5	4.5	7	2.5	2.5	1
Habitat fragmentation							
Magnitude and Type of Effects	Mod–	Mod–	Mod–	Mod–	Mod–	Mod–	Mod–
Ranking of Alternatives	6	4.5	4.5	7	2.5	2.5	1
Increased vulnerability to predators/vehicle collision							
Magnitude and Type of Effects	Mod–	Mod–	Mod–	Mod–	Mod–	Mod–	Mod–
Ranking of Alternatives	6	4.5	4.5	7	2.5	2.5	1
Facilities-related mortality							
Magnitude and Type of Effects	None	None	None	None	None	None	None
Ranking of Alternatives	None	None	None	None	None	None	None
Recreation							
Magnitude and Type of Effects	Minor–	Minor–	Minor–	Minor–	Minor–	Minor–	Minor–
Ranking of Alternatives	6	4.5	4.5	7	2.5	2.5	1
Noise							
Magnitude and Type of Effects	Mod–	Mod–	Mod–	Mod–	Mod–	Mod–	Mod–
Ranking of Alternatives	6	4.5	4.5	7	2.5	2.5	1
Development activity							
Magnitude and Type of Effects	Mod–	Mod–	Mod–	Mod–	Mod–	Mod–	Mod–
Ranking of Alternatives	6	4.5	4.5	7	2.5	2.5	1
Production activity							
Magnitude and Type of Effects	Minor–	Minor–	Minor–	Minor–	Minor–	Minor–	Minor–
Ranking of Alternatives	6	4.5	4.5	7	2.5	2.5	1

Notes:
1. None = immeasurable effect or compensating adverse and beneficial effects, Minor = individuals not likely affected, Mod = (moderate) individuals may be affected but populations would not be affected, "–" = negative effect, "+" = positive effect. Thus, Mod– is a moderate negative effect.
2. Rankings are in order from the least impact (1) to the greatest impact (7).

There would be some additional long-term, direct loss of towhee nesting and foraging habitat due to controlled burn, fuels reduction, and fire protection activities around project infrastructures. Controlled burns and fuels reduction projects have been conducted on the SJNF portion of the Project Area for many years, and would likely increase in the future. These projects reduce towhee habitat in two ways. First, through direct loss of habitat the extent of shrub habitat is reduced, and second through breaking up large shrub stands into smaller discontinuous patches. Habitat loss to controlled burns or fuels reduction projects are not included in the calculations presented in Table J–28, and therefore direct habitat loss is likely to be greater than predicted in the calculations.

Some shift in home range or displacement of individuals would occur where roads, facilities, pipelines or other infrastructure developments are in towhee habitat. This may occur due to direct loss of habitat or due to a reaction of individual birds to higher levels of human activity during construction (short term) and production (long term) phases. Given the large amount of towhee habitat and its well-distributed nature in the Project Area, some individuals may be affected by home range shift and displacement but it is unlikely to result in a population decline. Therefore, the magnitude of impact of this factor to towhees is moderate and negative.

Some fragmentation of towhee habitat would occur on the SJNF under all alternatives, where infrastructure is located in mountain shrub and gamble oak stands. On the SJNF, mountain shrub stands provide the highest quality towhee nesting and foraging habitat, but occur as relatively disjunct patches. The impact of road and facility infrastructure construction on the widely scattered mountain shrub habitat patches would be to increase fragmentation of high quality towhee habitat in the SJNF portion of the Project Area. Because of the small amount and relatively isolated nature of mountain shrub habitat patches on the SJNF, habitat fragmentation would affect some individual towhees. However, given the large amounts and interconnected nature of adjoining Gambel oak stands on the SJNF, fragmentation of the mountain shrub patches is unlikely to cause a towhee population decline. In addition, the small size of unsuitable habitat openings resulting from well pad and road corridor construction would not create barriers to towhee movements or dispersal. Therefore, the magnitude of impact of this factor to towhees is moderate and negative.

As new openings are created in towhee habitat, individuals may become more vulnerable to vehicle collisions or predators. However, towhees are rarely found dead along heavily traveled road corridors in southwestern Colorado. This is likely due to their preference for staying in or near patches of dense shrubby vegetation. They are not attracted to roadside habitats (i.e. mowed areas), and prefer to forage on foot in dense vegetation. Most new project roads would be gated and closed to public motorized travel and would therefore receive relatively low traffic volumes. Vehicle speeds would also be low due to design, terrain and travel management restrictions. Given the low volume and speed of traffic expected on new roads in the Project Area, and the lack of towhee mortality on much heavier traveled county roads in this area, the potential for this project to increase vulnerability of towhees to vehicle collisions is small.

Mammalian predators would be attracted to facility infrastructure and road corridors as human activity increases, and therefore losses of towhee nests or young near these facilities may increase. These losses are likely to be very small due to the preference of towhees for nesting in dense cover where nests are hard to detect and travel by mammalian predators is more difficult. For these reasons, a few individual towhees may be affected, but populations would not be affected. Therefore, the magnitude of impact of this factor to towhees is moderate and negative.

Direct loss of nesting habitat and reduction in foraging habitat quality due to project implementation poses much greater threats to green-tailed towhee than facility-related mortality. While it is possible that towhee mortality may occur at project facilities from exposure to mechanical or toxic substances, it is very unlikely. Towhees prefer to nest in low shrubs, on or near the ground. Therefore, the risk of facilities related mortality due to towhees nesting on or in them is remote. In addition, towhees prefer to forage on the ground in shrubs or nearby grassland, thus the potential for facilities-related mortality while foraging is also remote. Use of storage tanks, or mesh or other coverings over gray water storage pits will prevent exposure to this source of toxic risk. Because there is a remote risk to individual birds, the magnitude of this factors impact on towhees is determined to be no effect.

The impact of non-motorized recreation (foot, bike, and horse) on towhees is generally small. Because of the dense structure of mountain shrub and gamble oak stands, little recreation occurs within green-tailed towhee preferred nesting stands. Although some increase in the amount of non-motorized recreation along roads and trails in the SJNF portion of the Project Area may occur under all alternatives, the dense structure of towhee nesting and foraging habitat makes this species less sensitive to disturbance than species that breed in more open or more accessible habitats. In contrast to the SJNF, there is no increase expected in recreation on private land, and therefore no change is expected to towhee habitat effectiveness on private land in the Project Area.

Off-highway recreational vehicles (OHVs) are currently permitted throughout the SJNF portion of the Project Area. Under Alternatives 1 through 3, our travel management would restrict motorized travel to select existing roads and a few designated trails. Under current travel management guidelines that allow off-road motorized travel, loss of towhee nests to OHVs is likely to be very small due to the bird's preference for nesting in dense cover where few vehicles travel. OHVs may cause some disturbance to nesting towhees, but the frequently steep terrain in the SJNF portion of the Project Area limits OHV access to many towhee habitat areas. Therefore, the benefit to towhees of restricting OHV use to existing roads and trails will likewise be small. All new roads created by this project would be closed to public motorized use. Because motorized travel would be restricted to service and official business purposes only, public motorized recreational use of new roads would not reduce towhee habitat effectiveness. Because individual towhees are unlikely to be affected by motorized and non-motorized recreation, the magnitude of impact of this factor to towhees is minor, but negative.

Noise levels associated with development and production activities are expected to have both short and long-term effects. Noise associated with development activities such as drilling, and road and facility construction are considered short-term. Noise associated with production activities such as maintenance traffic, compressor stations and pump jacks are considered long-term. Noise levels associated with the production phase include maintenance traffic, compressor stations, pump jacks, etc. are generally long-term but would be measurably less than construction. Noise levels generated by pumpjacks would decrease to 50 dBA at 300 feet distance and noise associated with building enclosed compressors would drop to 50 dBA at 450 feet from the building, both within COGCC noise guidelines (Chapter 3, Noise Section). Some habituation to consistent and predictable noise sources would occur for many wildlife species, reducing the loss of habitat effectiveness as they adjust to these noise sources.

Increased human presence, traffic, construction, and production noise at project facilities would influence towhee habitat use and reduce towhee habitat effectiveness adjacent to facility sites to some degree for the short and long-term. However, these impacts are difficult to quantify because they depend on several factors including sensitivity of individual birds and availability and suitability of undisturbed habitats nearby. No formal studies have been conducted on the effect of disturbance or noise on towhees, but studies of other bird species in more open and heavily used habitats have shown significant reductions in habitat effectiveness in disturbed areas. As stated previously, towhees are less sensitive to disturbance than species that breed in more open or more accessible habitats. Thus noise would probably cause some degree of impact, but it is not known how far away from facilities that zone of impact might extend. However, given the large amount of occupied towhee habitat and its wide distribution across the Project Area, noise is unlikely to reduce towhee populations. Thus, the magnitude of impact of this factor to towhees is moderate, and negative.

Development activities are short term. The effects of direct loss of habitat from facility construction have been displayed in Table J–28 and discussed above in detail. The noise produced by project construction activities that coincide with towhee nesting season (late April through early July in the Project Area) would affect some individual towhees nesting in close proximity to construction areas, but at any given location, it would be short and temporary in duration. In addition, given the large amounts and interconnected nature of towhee habitat through out the Project Area, this activity is not likely to cause a towhee population decline. Therefore, the magnitude of impact of this factor to towhees is moderate, and negative.

The impacts of activities associated with production are expected to be much less than the impacts of activities associated with project construction. In most cases, production activity is limited to one pickup truck visit of 5 to 20 minute duration per day to each well pad site for equipment monitoring purposes. Sites with telemetry would be visited much less often. Compressor stations would be visited more often, for longer periods of time, and by larger class vehicles. Most of this activity is routine in nature, is predictable and regular in pattern, and therefore most wildlife species quickly habituate to it. As stated previously, because of their preference for nesting and foraging in dense shrub habitats, towhees are less sensitive to disturbance than species nesting in more open habitats and therefore

are not likely to be affected by routine production activities. Because individual towhees are unlikely to be affected by production activities, the magnitude of impact of this factor to towhees is minor and negative.

J.4.2.5.3 Cumulative Effects

The past, present, and reasonably foreseeable cumulative effects on green-tailed towhee habitat is given in Table J–30. Figures presented in this table include past development and approved oil and gas development in the Project Area and on all land within the cumulative effects area, along with proposed oil and gas development in the Project Area.

Table J–30 Extent and Proportion of Cumulative Effects on Green-tailed Towhee Habitat

	Existing Effects	Alternative							Habitat Available (acres)
		1	1A	1B	2	3	4	5	
NFS land									
Acres	14	670	506	490	892	502	532	349	30,678
Percent	0.05	2.2	1.6	1.6	2.9	1.6	1.7	1.1	
Cumulative Effects Analysis Area									
Acres	14,443	15,286	15,139	15,102	15,695	15,118	15,147	14,971	307,856
Percent	4.7	5	4.9	4.9	5.1	4.9	4.9	4.9	

Habitat loss associated with oil and gas development throughout the cumulative affects area is low, resulting in no more than 5.1-percent habitat loss. Additional factors of concern that may affect green-tailed towhee populations and their habitat include timber harvesting, forest restoration, fuels reduction, fire suppression, grazing, road building, agricultural development, rural development, and recreation. These activities have altered the amount, distribution, and suitability (both positive and negative) of towhee habitat beyond the cumulative loss associated with oil and gas development shown in Table J–25. For example, timber harvest over the past 60 years has converted 1,535 acres of ponderosa pine forest on SJNF land within the Project Area to other vegetation types, primarily Gambel oak, resulting in a net increase in available towhee habitat. Fire suppression has also changed the structure of ponderosa pine stands. In general, fire suppression has increased the amount and density of Gambel oak and other shrub species through out the Project Area.

On non-Federal land, past agricultural and residential development and associated fire suppression activities have resulted in expansion of shrub, pinyon-juniper, and grassland habitats, thereby increasing the amount of towhee habitat in the Project Area and cumulative effects area. Anticipated continued population growth in the cumulative effects area suggests that towhee habitat may also continue to expand, particularly in the western portions of the Project Area. Other activities that occur in the cumulative effects area and affect towhee habitat include continued fire suppression, grazing, and timber harvest. These activities would have both positive and negative effects on towhee habitat, distribution, and populations over the short and long term, but a quantitative prediction of the combined effect of these activities is difficult beyond site-specific examples.

Qualitatively however, continued fuel reduction, grazing, oil and gas and urban development activities are likely to gradually reduce the amount of towhee habitat in the cumulative effect area. However, unless the scope of these activities changes significantly in the future, these activities are not likely to change the overall distribution of towhee habitat across the area. Conversely, continued timber harvest and fire suppression activities are likely to increase the amount of shrub habitats available to towhee across the area.

Residential development, and associated habitat management activities are the major factors affecting towhee habitat and populations. Compared to the effects of these activities, the proposed project would have only a slight influence on towhee abundance and no effect on towhee distribution across the cumulative effects area, even if the most extensive alternative were chosen.

J.4.2.5.4 Relationship of Project Effects to Forest-wide Population and Habitat Trends

This section tiers to Forest-wide MIS Assessment, and evaluates how implementation of the proposed project would contribute to green-tailed towhee population and habitat trends across the entire SJNF. Green-tailed towhee populations are currently stable and well distributed continuously across the SJNF and well beyond the Forest's administrative boundary through out southwestern Colorado. Towhee density in the Project Area is similar to estimates from Statewide surveys individuals within the SJNF do not constitute an isolated or unique population for which there is a viability concern. The alternatives would result in a 0.7 percent to 1.7 percent decline in the potential of the Project Area to support towhees, and a 0.2 percent to 0.4 percent decline in the potential of the entire SJNF to support towhees. Thus the alternatives would contribute negligibly to the SJNF's stable 20-year towhee population trend, and would not effect the distribution of towhees across the Forest or connectedness with populations on other nearby land ownerships.

The Forest-wide green-tailed habitat trend was down by about 7.0 percent over the 20-year analysis period. This decline was primarily the result of a shift in aspen stand structure in a number of stands Forest-wide from the seedling stage and into sapling pole stages. Towhees occupy this habitat type on the SJNF, but at much lower abundance (0.03 birds per hectare) than other preferred habitats such as mountain shrub (2.65 birds per hectare). The Forest-wide trend in all other habitat types across the 20-year analysis period was stable (-0.13 percent). The most impacting alternative would contribute an additional 0.3 percent reduction and result in a total Forest-wide rate of towhee habitat decline of -0.43 percent across the 20-year time period. The least impacting alternative would result in a 0.17 percent reduction in habitat over the 20-year period. Thus the alternatives would negligibly influence the overall Forest-wide rate of change of towhee habitat. The project would not compromise populations or long-term population trend across the SJNF.

J.4.2.6 Hairy Woodpecker

This section discusses project effects, cumulative effects, and relationship to Forest-wide habitat and population trends for hairy woodpecker. The analysis tiers to

the SJNF's Forest-wide MIS Assessment. The analysis assumes the effective implementation of all project design and mitigation measures described in the EIS.

Limiting factors that are of concern are nest site and food availability. Strong evidence suggests that the density of cavity nesting birds is directly related to snag density, with cavity nesters selecting large snags of certain preferred species (Hejl 1994). Local populations of hairy woodpeckers fluctuate somewhat in response to insect infestations and fire (Andrews and Righter 1992).

J.4.2.6.1 Species Biology and Affected Environment

The hairy woodpecker (*Picoides villosus*) was selected as an MIS in the Forest Plan for the SJNF because it uses a "unique habitat, habitat that can be monitored." This project uses hairy woodpecker as an indicator of effects on a variety of species that depend on snags and green, decaying trees for foraging substrate or nesting cavities. Winternitz (1976) stated that 40 percent of montane breeding birds require nest holes, and only 8 percent are woodpeckers able to excavate cavities. Species in the Project Area that depend on tree cavities or green trees with heartwood decay include American kestrel, flammulated owl, five species of woodpeckers, ash-throated flycatcher, three species of swallows, two species of chickadees, juniper titmouse, brown creeper, house wren, and two species of bluebirds.

The hairy woodpecker is a nonmigratory species that can be found in much of North America year-round. This species prefers ponderosa pine, Douglas-fir, lodgepole pine, spruce-fir, and aspen forests, as well as riparian forests, piñon-juniper woodland, and urban areas with tall trees (Andrews and Righter 1992). Hairy woodpeckers have also been shown to be associated with old-age (250 to 500 years) forests (Ruggiero et al. 1991, Hejl 1994), and to prefer live trees with heartwood rot (Gano 1981). They are associated with areas that have a high understory density and large-diameter snags over 12 inches d.b.h. (Evans and Conner 1979, McComb 1985). Surveys on the SJNF have found active nest trees with average diameters of 12.9 inches d.b.h. (Schultz 2001) and 11.9 inches d.b.h. (Ortega 2003).

The hairy woodpecker has no federal or state status (USFWS 2003, CDOW 2002). It has no global or state conservation status (CNHP 2002). It is protected under the Migratory Bird Treaty Act (APHIS 2002). The *Partners in Flight* Conservation Priority Scoring process gives it a score of 14 (of a maximum possible score of 35), using the Colorado population trend value from the North American BBS, and a score of 17, using the continental population trend value (Colorado Bird Observatory 1997).

Across the United States, hairy woodpeckers breed in extensive, mature forests of deciduous, coniferous, and mixed trees. They seek woodlands with dense canopies formed by large trees and a complement of dead stubs and fallen logs. Hairy woodpeckers favor clumps of dead aspen and green trees with decayed heartwood; they excavate a new hole each year (Winternitz 1998). Nest excavation has also been reported in ponderosa pine, mixed conifer, white fir, lodgepole pine, and subalpine fir (Thomas et al. 1979, Schultz 2001, Ortega 2003).

In Colorado, hairy woodpeckers live throughout the state, from timberline to the plains, and are more common in the mountains in the summer and at lower elevations in the winter (Andrews and Righter 1992, Winternitz 1998). The Colorado Breeding Bird Atlas confirms breeding in the following habitat types: 31 percent in aspen forests; 20 percent in upland, coniferous forests; 14 percent in ponderosa pine; and 11 percent in piñon-juniper (Winternitz 1998). The mountain subspecies (*P. v. monticola*) found in the San Juan Mountains occurs predominantly in conifers (61 percent of Atlas records), although a substantial number (36 percent) use aspen forests and deciduous-foothills streams, which usually have some streamside or mountainside conifers (Winternitz 1998).

Population trend data for hairy woodpecker from the BBS shows a statistically significant increase since 1966 at the continental (survey-wide) scale (Sauer et al. 2001). BBS trend estimates for the state of Colorado show an insignificant increase, and a nearly equal but insignificant decrease for the Southern Rockies.

BBS data for hairy woodpeckers in Colorado and the Southern Rockies are highly variable; therefore they do not track population trends accurately at other than large geographic scales and long time intervals. Despite this, BBS data appear to represent correctly where woodpeckers are thought to be most abundant.

Audubon has conducted CBCs annually across the United States and Canada since 1900. Survey-wide, the trend in hairy woodpecker detections has been stable (1959 to 1991). Similar to BBS data, CBC data are most appropriately used at large scales and long time intervals, and CBC data also appear to be a reasonable representation of where woodpeckers are thought to be most abundant in winter. Given the qualitative agreement between CBC and BBS population trend data, it is reasonable to conclude that hairy woodpecker populations are stable across southwestern Colorado, including the SJNF.

On the SJNF, hairy woodpeckers are detected nearly every year on most North American Breeding Bird Survey routes. The Monitoring Colorado Birds partnership has found hairy woodpeckers on most transects conducted in suitable habitat on the SJNF, including one in the Project Area. The Durango CBC, conducted annually since 1945, is the only CBC near the SJNF or the Project Area, and hairy woodpeckers are detected every year. Colorado Breeding Bird Atlas records show the hairy woodpecker is well distributed across the SJNF and well beyond the Forest's administrative boundary, throughout southwestern Colorado. Therefore, based on species distribution and habitat maps and field experience, no evidence has been found to suggest that individuals within the SJNF constitute an isolated or unique population for which there is a viability concern.

Based on the MIS habitat model, the trend in Forest-wide habitat for hairy woodpecker has been slightly upward since 1983, and has been strongly influenced by a significant upward trend in mature-aspen acreage. The Forest-wide trend in all of the habitat types used by woodpeckers that occur in the Project Area has been stable since 1983.

We calculated acreage of hairy woodpecker habitat based on the MIS habitat model presented in the San Juan National Forest MIS Assessment. This model estimates there are 25,467 acres of hairy woodpecker habitat on SJNF land in the

Project Area, about 52 percent of SJNF land in the Project Area (Table J–7). There are 59,231 acres of hairy woodpecker habitat on all land in the Project Area, about 47 percent of the total land base in the Project Area (Table J–8). There are 63,019 acres of woodpecker habitat in the SUIT EIS Study Area to the south of the Project Area, and therefore 122,250 acres in the Cumulative Effects Analysis Area (Table J–9). The largest blocks of woodpecker habitat are located on NFS land in the eastern half of the Project Area. The next largest blocks of habitat in the Project Area are on private land in the western portion of the Project Area. Habitat on BLM and State land is limited.

Surveys for hairy woodpecker were conducted on SJNF land in the Project Area during summer 2003. These surveys targeted areas that the SJNF MIS habitat model predicted were woodpecker habitat. A total of 2,212 acres on 9 transects was surveyed, and 13 woodpeckers were detected. Using distance estimation techniques (Buckland et al. 1993), woodpecker density was estimated at 0.021 birds per hectare (0.009 birds per acre). This density estimate is very similar to results from statewide surveys (Leukering et al. 2001). Statewide surveys reported woodpecker density varying by habitat type, from a low of 0.01 birds per hectare in piñon-juniper to a high of 0.08 birds per hectare in aspen, with an estimate of 0.04 birds per hectare in ponderosa pine. Additional, less formal inventories were conducted in the Pargin Mountain area during June 2003; hairy woodpeckers were observed "on occasion" in ponderosa pine, mountain shrub, and riparian habitats (Clark 2003). Other surveys in the Pargin Mountain area during 2002 found hairy woodpeckers to be "fairly common in all coniferous woodlands and forests" (Black and Wood 2003).

Within the Project Area, the most abundant habitat type used by hairy woodpecker is ponderosa pine, with about 56 percent of this habitat type occurring on the SJNF. The next most abundant habitat type is piñon-juniper, about 37 percent on the SJNF. Mixed conifer is far less abundant than the previous habitats, but 95 percent is on the SJNF. Most of the ponderosa pine on the SJNF portion of the Project Area is on gentle, lower slopes from 6,800 to 7,800 feet elevation, and on north-facing slopes. About 96 percent of the ponderosa pine in the SJNF portion of the Project Area meets the criteria in the MIS habitat model for hairy woodpecker habitat, and 4 percent is inventoried old growth.

Most of the mixed conifer in the Project Area is at higher elevations on north-facing slopes. Aspen is uncommon in the Project Area and occurs mainly as stringers along intermittent drainages, or in a few stands on north slopes. In the past 10 years there has been some timber harvest and controlled burns, mostly in ponderosa pine in the Sauls Creek and Spring Creek areas and Lange and Bull Canyons. Snag density is lower in these areas than in unroaded areas or old-growth stands, thereby reducing their value for hairy woodpeckers. Areas like Sauls Creek that receive heavy summer and fall recreation use have further reduced snag density, due to personal-use fuelwood cutting.

Hairy woodpeckers rely primarily on snags and green trees with heartwood decay for nesting and foraging substrate. For this reason, we assume that the limiting factor on hairy woodpecker populations is the number and distribution of snags and standing green trees with heartwood rot (Hejl 1994). Accordingly, reduced snag density should reduce hairy woodpecker habitat quality. At the scale of the

entire SJNF, there are sufficient snags in piñon-juniper, aspen, mixed-conifer, and spruce-fir habitats to maintain viable populations of hairy woodpeckers on the SJNF.

We also believe that snag density in ponderosa pine habitat is generally below Forest Plan guidelines in easily accessed areas, including some parts of the Project Area, although snag-density data across the entire ponderosa pine type are unavailable. Old-growth stands and remote, steep canyons have been found to have higher snag density than more accessible areas or areas with regular management activities.

The generally low pine snag density Forest-wide is primarily due to fuelwood cutting and past timber harvest practices. Because of concerns about low density of snags and green trees with heartwood decay in the ponderosa pine type, snags are protected during project activities, pine-restoration and other timber harvest treatments, and prescribed burns. In addition, cutting standing, dead ponderosa pine for fuelwood has been prohibited on the Dolores and the Pagosa Ranger Districts. Given these measures, along with recent increases in mountain pine beetle activity in the ponderosa pine type on the SJNF, we expect density of snags and green trees with heartwood decay to increase in the near future, and therefore the presumed amount of hairy woodpecker nesting and foraging habitat is also expected to increase.

Data collected in part on the SJNF show that cavity-dependant species like the hairy woodpecker prefer the largest-diameter snags available, and that this preference is maintained as average stand diameters increase (Schultz 2001). This study found that the diameter of trees used by cavity-nesting birds greatly exceeds the definition of a snag that is used by the Forest Plan (FS 1992). The SJNF LMP defines a snag as "a dead tree that is free-standing, greater than 8 inches d.b.h., and at least 10 feet in height." All active nest cavity snags located in the study (Schultz 2001) exceeded the diameter and height of the LMP snag definition. Although the average diameter of active cavity-nest trees in this study was 17.3 inches d.b.h, half of all cavity nests were found in trees that exceeded 21 inches d.b.h. In addition, the average diameter of active ponderosa pine cavity trees was 21.7 inches d.b.h. A study in Arizona (Rosenstock 1996) found that abundance of cavity-nesting birds increased with increasing proportion of large-diameter snags, increasing proportion of tall snags, and increasing snag density

J.4.2.6.2 Direct and Indirect Effects

Varying amounts of habitat for hairy woodpecker would be removed under each alternative (Table J–31). The habitat impacts would resemble small openings of approximately 1.5 acres in size. Along road and utility corridors, habitat removal would be linear openings of varying lengths, averaging 40 feet in width. All vegetation within the 40-foot wide corridor would be removed. Pipelines and utility lines would be placed under or next to roadbeds, buried, then re-contoured and replanted.

The extent of impacts on hairy woodpecker would depend primarily on the number of wells drilled, the length of access roads to those wells, and the juxtaposition of infrastructure facilities to hairy woodpecker habitat. The predicted acres of hairy woodpecker habitat lost to facility development under each of the alter-

natives are shown in Table J–31. Based on direct habitat loss, Alternative 2 is the most extensive to woodpeckers in both the short and long term, followed in descending order by Alternatives 1, 1A, 1B, 3, 4, and 5. Within the National Forest Portion of the Project Area, Alternative 2 is again the most extensive to habitat followed in descending order by Alternatives 1, 4, 3, 1A, 1B, and 5.

Table J–31 Extent and Proportion of Affected Hairy Woodpecker Habitat

	Alternative							Habitat Available (Acres)
	1	1A	1B	2	3	4	5	
NFS Land								
Acres	658	566	494	851	390	397	332	25,467
Percent	2.9	2.2	1.9	3.3	1.5	1.6	1.3	
Project Area								
Acres	723	637	559	953	455	463	415	59,231
Percent	1.2	1	0.9	1.6	0.8	0.8	0.7	

Table J–32 summarizes the magnitude of positive or negative effects on hairy woodpecker, and ranks alternatives from most to least extensive. The rankings displayed in Table J–32 are based on the percent of woodpecker habitat lost under each alternative (Table J–31) and the juxtaposition of woodpecker habitat to proposed facilities. In general, the amount of habitat lost under all alternatives is relatively small (< 2-percent), and effects of factors are moderate. Based on estimates of woodpecker density and amount of woodpecker habitat in the Project Area, implementing any of the proposed alternatives would result in a 0.8-percent to 1.9-percent decline in the potential of the Project Area to support hairy woodpeckers. Thus, some individuals may be affected but none of the factors or alternatives is likely to cause a measurable decline in woodpecker populations.

Removal of hairy woodpecker habitat would create small gaps in previously continuous forest canopies. The effects of this modification of woodpecker's habitat includes direct loss of nesting and foraging habitat, as well as creation of small barriers to movements of birds who prefer to remain within the forest canopy. However, the small forest openings created by infrastructure sites and road corridors resemble the many openings that currently occur through out the area, and thus are unlikely to significantly reduce the quality of the area for woodpeckers. The effect of these openings on woodpecker habitat would be long-term because it would take many decades after project completion before reclaimed sites return to a continuous forest canopy and again provide woodpecker habitat.

The estimate of hairy woodpecker density in the Project Area (0.009 birds per acre) was used to calculate an index of the effect of habitat loss on individual birds. This is not intended to represent a population estimate across the entire Project Area, but rather is an index to the potential of the modeled woodpecker habitat to support individual birds and is used as a comparative tool. Alternative 2, the most impacting alternative, results in the loss of 953 acres of woodpecker habitat in the Project Area, which has the potential to support 9 woodpeckers. Alternative 5, the least extensive alternative, results in the loss of 415 acres of

woodpecker habitat in the Project Area, which has the potential to support 4 woodpeckers. In contrast, the Project Area has 53,636 acres of modeled woodpecker habitat, which has the potential to support 483 woodpeckers. Thus implementing any of the proposed alternatives would result in a 0.8-percent to 1.9-percent decline in the potential of the Project Area to support hairy woodpeckers.

Table J–32 Relative Impacts on Hairy Woodpecker, by Alternative

Factor	Alternative						
	1	1A	1B	2	3	4	5
Direct habitat loss							
Magnitude and Type of Effects[1]	Mod–	Mod–	Mod–	Mod–	Mod–	Mod–	Mod–
Ranking of Alternatives[2]	6	5	4	7	3	2	1
Home range shift and displacement							
Magnitude and Type of Effects	Mod–	Mod–	Mod–	Mod–	Mod–	Mod–	Mod–
Ranking of Alternatives	6	5	4	7	3	2	1
Habitat fragmentation							
Magnitude and Type of Effects	Minor–	Minor–	Minor–	Minor–	Minor–	Minor–	Minor–
Ranking of Alternatives	6	5	4	7	3	2	1
Increased vulnerability to predators/ vehicle collision							
Magnitude and Type of Effects	Mod–	Mod–	Mod–	Mod–	Mod–	Mod–	Mod–
Ranking of Alternatives	6	5	4	7	3	2	1
Facilities-related mortality							
Magnitude and Type of Effects	None	None	None	None	None	None	None
Ranking of Alternatives	None	None	None	None	None	None	None
Recreation							
Magnitude and Type of Effects	Mod+	Mod+	Mod+	Mod+	Mod+	Mod+	None
Ranking of Alternatives	6	5	4	7	3	2	1
Noise							
Magnitude and Type of Effects	Mod–	Mod–	Mod–	Mod–	Mod–	Mod–	Mod–
Ranking of Alternatives	6	5	4	7	3	2	1
Development activity							
Magnitude and Type of Effects	Mod–	Mod–	Mod–	Mod–	Mod–	Mod–	Mod–
Ranking of Alternatives	6	5	4	7	3	2	1
Production activity							
Magnitude and Type of Effects	Minor–	Minor–	Minor–	Minor–	Minor–	Minor–	Minor–
Ranking of Alternatives	6	5	4	7	3	2	1

Notes:
1. None = immeasurable effect or compensating adverse and beneficial effects, Minor = individuals not likely affected, Mod = (moderate) individuals may be affected but populations would not be affected, "–" = negative effect, "+" = positive effect. Thus, Mod– is a moderate negative effect.
2. Rankings are in order from the least impact (1) to the greatest impact (7).

There would be some additional and long-term direct loss of woodpecker habitat due to controlled burn, fuels reduction, and fire protection activities around project infrastructures. The goal of these projects is to reduce fuel loads and ladder fuels and to reduce the risk of fire carrying through the stands or climbing into the tree crowns. These projects often target removal of understory, dead and dying trees which are required nesting and foraging substrate for woodpeckers. Unless efforts are taken to protect large-diameter (>16 inch d.b.h.) snags, they are often lost to controlled burns and thus result in declining habitat quality for primary cavity excavators (such as woodpeckers) and secondary cavity nesters

(such as bluebirds). Although controlled burns often kill smaller understory trees, thereby creating smaller snags that are used for foraging substrate by woodpeckers, controlled burns are rarely allowed to burn hot enough to create snags out of the larger overstory trees that have sufficient diameter (>9 inches d.b.h.) for nest cavity construction.

Some shift in home range or displacement of individual birds would occur where roads, facilities, pipelines or other infrastructure developments intersect woodpecker habitat. This may occur due to direct loss of habitat or due to a reaction of individual birds to higher levels of human activity during the construction (short term) and production (long term) phases. The degree to which hairy woodpeckers are displaced would depend on the duration of construction, amount of disturbance caused by operating facilities and service visits, loss of key habitat components (i.e. snags), and tolerance of individual birds to disturbance. Given the large amount of woodpecker habitat and its well-distributed nature in the Project Area, some individuals may be affected by home range shift and displacement but it is unlikely to result in a population decline. Therefore, the magnitude of impact of this factor to woodpeckers is moderate, and the effect is negative.

Some fragmentation of woodpecker habitat would occur where facilities are constructed in ponderosa pine stands. However, abundant woodpecker habitat would remain adjacent to disturbed areas and connected to other blocks of habitat. Newly constructed roads and infrastructure sites would not create barriers to woodpecker movement or dispersal or create isolated habitat from forested stands, but these openings may reduce the amount of woodpecker use in some individual stands. However, given the large amounts and interconnected nature of ponderosa pine stands on the SJNF portion of the Project Area, fragmentation of a few stands is unlikely to cause a woodpecker population decline. Therefore, the magnitude of impact of this factor to woodpeckers is moderate, and the effect is negative.

As new openings are created in woodpecker habitat, individuals may become more vulnerable to vehicle collisions or predators. However, woodpeckers are rarely found dead along heavily traveled road corridors in southwestern Colorado. This is likely due to their preference for staying within forest canopies. They are not attracted to roadside habitats and prefer to forage within forest canopies. Most new roads would be gated and closed to public motorized travel and therefore receive relatively low traffic volumes. Vehicle speeds would also be low due to design, terrain and travel management restrictions. Given the low volume and speed of traffic expected on new roads in the Project Area, and the lack of woodpecker mortality on much heavier traveled county roads in this area, the potential for this project to increase vulnerability of woodpeckers to vehicle collisions is small.

Mammalian predators would be attracted to facility infrastructure and road corridors as human activity increases, and therefore losses of woodpecker nests near these facilities may increase. However, birds that nest in tree cavities have much lower nest predation rates than open cup nesting birds due to the difficulty most predators have in reaching their nests. For these reasons, a few individual woodpeckers may be affected, but overall populations would not be affected. There-

fore, the magnitude of impact of this factor to woodpeckers is moderate, and the effect is negative.

Direct loss of nesting habitat and reduction in foraging habitat quality due to project implementation pose much greater threats to hairy woodpeckers than facility-related mortality. While woodpecker mortality may occur at project facilities from exposure to mechanical or toxic substances, the probability of this environmental consequence is remote. Woodpeckers prefer to remain in forest canopies and rarely forage on structures that are distant from a forest canopy as most project facilities would be. Use of storage tanks, or mesh or other coverings over gray water storage pits would prevent exposure to this source of toxic risk. Because there is a remote (i.e. un-measurable) risk to individual birds, the magnitude of impact of this factor to woodpeckers is determined to be no effect.

The impact of non-motorized recreation (foot, bike, and horse) on woodpeckers is generally small because woodpeckers remain within forest canopies and much of the recreation in this area occurs along roads, trails, and forest openings. Although some increase in the amount of motorized and non-motorized recreation along roads and trails in the SJNF portion of the Project Area may occur under all alternatives, woodpeckers are less sensitive to disturbance than species that inhabit more open or more accessible habitats. New roads would open foot and horseback access to previously lightly utilized portions of the Project Area but woodpeckers are tolerant of short duration disturbance associated with dispersed recreational activities. Motorized and non-motorized recreation could result in some short distance displacement of individual woodpeckers to adjacent habitat within their home range or a change in behavior that temporarily disrupts activity. In contrast to the SJNF, there is no increase expected in recreation on private land, and therefore no change is expected to woodpecker habitat effectiveness on private land in the Project Area. OHVs are currently permitted through out the SJNF portion of the Project Area. Alternatives 1 through 3 would change travel management and restrict motorized travel to selected roads and a few designated trails. OHVs may have caused some disturbance to woodpeckers, but the steep terrain in the SJNF portion of the Project Area limits OHV access into many forest stands. Therefore the benefit to woodpeckers of restricting OHV use to existing roads and trails would likewise be small. All new roads resulting from this project would be closed to public motorized use. Because motorized travel would be restricted to service and official business purposes only, public motorized recreational use of new roads would not reduce woodpecker habitat effectiveness.

Another potential impact of recreation activities is the loss of snags to camping and personal-use fuelwood cutting. Along roads open to public motorized travel and areas receiving heavy recreational use, such as Sauls Creek, snag density is much reduced, due to personal-use fuelwood cutting. The limiting factor on hairy woodpecker populations is the number and distribution of snags and standing green trees with heartwood rot (Hejl 1994), therefore, reductions in snag density would result in reductions in hairy woodpecker habitat quality. Snag densities in ponderosa pine habitat are generally below Forest Plan guidelines in easily accessed areas, including some parts of the Project Area. Although some additional reductions in snag density would occur in localized areas as this project is implemented, the large amounts and interconnected nature of ponderosa pine stands on the SJNF portion of the Project Area would prevent widespread woodpecker

population declines. Travel management restrictions would also protect many snags from cutting that are near roads constructed for the project, thereby protecting a key woodpecker habitat component. Because individual woodpeckers would be affected by recreation but populations would not be affected, the magnitude of impact of this factor to woodpeckers is moderate, and negative.

Noise levels associated with development and production activities are expected to have both short and long-term displacement impacts. Noise levels associated with the production phase include maintenance traffic, compressor stations, pump jacks, etc. are generally long-term but would be measurably less than construction. Noise levels generated by pumpjacks while in use, would decrease to 50 dBA at 300 feet distance and noise associated with building enclosed compressors would drop to 50 dBA at 450 feet from the building, both within COGCC noise guidelines (Chapter 3, Noise Section). Some habituation to consistent and predictable noise sources would occur for many wildlife species, reducing the loss of habitat effectiveness as they adjust to these noise sources.

Increased human presence, traffic, construction, and production noise at project facilities would influence woodpecker habitat use and reduce habitat effectiveness adjacent to facility sites to some degree for the short and long term. However, these impacts are difficult to quantify because they depend on several factors including sensitivity of individual birds and availability and suitability of undisturbed habitats nearby. No formal studies have been conducted on the effect of disturbance or noise on woodpeckers, but studies of other bird species in more open and heavily used habitats have shown significant reductions in habitat effectiveness in disturbed areas. As stated previously, woodpeckers are less sensitive to disturbance than species that breed in more open or more accessible habitats. Thus noise would likely have some impact, but it is not known how far away from facilities that zone of impact might extend. Some reduction in habitat effectiveness would probably occur and some individuals would probably be affected. However, given the large amount of occupied woodpecker habitat and its wide distribution across the Project Area, noise is unlikely to reduce woodpecker populations. Thus, the magnitude of impact of this factor to woodpeckers is moderate and negative.

Construction of individual facilities is expected to occur rapidly; therefore the effect of this activity at any construction site is short term in nature. The direct loss of habitat from facility construction has been displayed in Table J–31 and discussed above in detail. The noise produced by project construction activities that coincide with woodpecker nesting season (late April through early July in the Project Area) would affect some individual woodpeckers nesting in close proximity to construction areas, but at any given location, it would be short and temporary in duration. In addition, given the large amounts and interconnected nature of woodpecker habitat across the Project Area, this activity is not likely to result in woodpecker population decline. Therefore, the magnitude of impact of this factor to woodpeckers is moderate and negative.

The impacts of production activities are expected to be much less than the construction impacts. In most cases, production activity is limited to one pickup truck visit of 5 to 20 minute duration per day to each well pad site for equipment monitoring purposes. Sites with telemetry would be visited less often. Compres-

sor stations would be visited more often, for longer periods of time, and by larger class vehicles. Most of this activity is routine in nature and is predictable and regular in pattern, therefore most wildlife species quickly habituate to it. As stated previously, because of their preference for remaining in forest canopies, hairy woodpeckers are less sensitive to disturbance than species nesting in more open habitats and therefore are not likely to be affected by routine production activities. Because individual woodpeckers are unlikely to be affected by production activities, the magnitude of impact of this factor to woodpeckers is minor and negative.

J.4.2.6.3 Cumulative Effects

The past, present, and reasonably foreseeable cumulative effects on hairy woodpecker habitat is given in Table J–33. Statistics include existing oil and gas development and approved oil and gas development within the boundary of the Southern Ute Reservation, and development projected for each alternative in the Project Area. Cumulative effects are therefore the sum of existing and projected oil and gas development within the cumulative effects area.

Table J–33 Extents and Proportion of Cumulative Effects on Hairy Woodpecker Habitats

	Existing Effects	Alternative							Habitat Available (acres)
		1	1A	1B	2	3	4	5	
NFS land									
Acres	19	677	585	513	870	409	416	351	25,467
Percent	0.07	2.7	2.3	2	3.4	1.6	1.6	1.4	
Cumulative Effects Analysis Area									
Acres	3,746	4,469	4,383	4,305	4,699	4,201	4,209	4,161	122,250
Percent	3.1	3.7	3.6	3.5	3.8	3.4	3.4	3.4	

Habitat loss associated with oil and gas development throughout the cumulative effects area is low even for the most extensive alternative (Alternative 2, 3.8-percent habitat loss). CBM gas production on private land in the Project Area and on Southern Ute Tribal land has resulted in over 2,000 wells drilled to date. Approximately 1,000 wells have been drilled in woodlands that could be considered hairy woodpecker habitat. These wells have resulted in the loss of about 3,000 acres of the total 122,250 acres of woodpecker habitat (2.6 percent) within the cumulative effects area. This activity is expected to continue for the near future, resulting in continued loss of hairy woodpecker habitat in these areas.

Additional factors of concern that may affect hairy woodpecker populations and their habitat include timber harvesting, forest restoration, fuels reduction and fire suppression, grazing, road building, agricultural and rural development, and recreation. These activities have altered the amount, distribution, and suitability (both positive and negative) of woodpecker habitat beyond the cumulative loss associated with oil and gas development shown in Table J–33.

Timber harvest has converted 1,535 acres of ponderosa pine forest on national forest land within the Project Area to other vegetation types, primarily Gambel oak, resulting in a net loss of available woodpecker habitat. The stand structure

of another 4,960 acres of ponderosa pine has been altered by timber harvest during this same period. The effects of these harvests on woodpecker habitat are likely both negative (loss of large-diameter snags and replacement trees) and positive (stand improvement harvests designed to promote more clumps of larger trees and reduce stand stocking rates).

Fire suppression has increased the density of ponderosa pine stands on the SJNF and BLM portions of the Project Area and Southern Ute Tribal land. Pine stands on these ownerships have become more densely stocked with smaller diameter trees; have more uniform stand structures and more closed canopies. Increased pine stand density have resulted in greater mortality of small diameter trees, providing foraging substrate for woodpeckers, but the reduction in trees in the largest diameter classes (less than 16 inches d.b.h.) has reduced the availability of preferred woodpecker nesting substrate. Local hairy woodpecker populations fluctuate in response to insect infestations particularly after fire (Andrews and Righter 1992). Thus across the cumulative effects area, fire suppression has removed a source of seasonally abundant food for woodpeckers that may have been abundant in some years following natural wild fires.

On non-Federal land, the past agricultural and residential development and associated road construction and fire suppression activities have probably resulted some ponderosa pine loss and expansion of shrub, pinyon-juniper and grassland habitats, thereby reducing the amount of woodpecker habitat in the Project and cumulative effects areas. While the extent of residential developments impact is not quantified, this increase has been widespread and continual through out the area, and has reduced hairy woodpecker habitat to a greater extent than CBM development. Anticipated continued residential growth in the cumulative effects area suggests that woodpecker habitat will continue to decline, particularly in the western portion of the Project Area.

Other cumulative effects, such as reduced habitat effectiveness and habitat fragmentation, are not quantifiable. These effects on public and tribal land result from oil and gas development, road construction and fire management programs. On private land, residential development and associated habitat management activities are the major factors affecting woodpecker habitat and populations. Compared to the effects of these activities, the alternatives would only slightly influence woodpecker abundance and have no effect on woodpecker distribution across the cumulative effects area.

J.4.2.6.4 Relationship of Project Effects to Forest-wide Population and Habitat Trends

This section tiers to Forest-wide MIS Assessment, and evaluates how implementation of the proposed project would contribute to hairy woodpecker population and habitat trends across the entire SJNF. Hairy woodpecker populations are currently stable and well distributed continuously across the SJNF and well beyond the SJNF's administrative boundary throughout southwestern Colorado. Woodpecker density in the Project Area is similar to estimates from statewide surveys and no evidence has been found to suggest that individuals within the SJNF constitute an isolated or unique population for which there is a viability concern.

The alternatives would result in a 0.8-percent to 1.9-percent decline in the potential of the Project Area to support woodpeckers, and a 0.03-percent to 0.08-percent decline in the potential of the entire SJNF to support woodpeckers. Thus, the alternatives would contribute negligibly to the Forest's stable 20-year woodpecker population trend, and would not affect the current well-distributed nature of woodpeckers across the Forest or connectedness with populations on other nearby land ownerships. The project would not compromise population viability or long-term population trend across the SJNF.

Hairy woodpecker habitat has increased by about 3.8-percent Forest-wide over the 20-year analysis period. This increase was primarily the result of a shift in aspen stand structure Forest-wide from small and intermediate size classes into mature size classes. The Forest-wide trend in all other habitat types across the 20-year analysis period was stable (+0.2-percent). The most extensive alternative (Alternative 2) would reduce the Forest-wide rate of increase in hairy woodpecker habitat by 0.09-percent and result in a total Forest-wide rate of woodpecker habitat increase +3.7-percent across the 20-year time period. The least extensive alternative (Alternative 5) would change the rate of habitat increase by 0.03-percent over the 20-year period. Thus, the alternatives would have a negligibly influence the overall Forest-wide rate of change of woodpecker habitat. The SJNF would continue to provide habitat to support current populations of hairy woodpecker and the habitat would be well distributed so that individuals can interact with others in the planning area. The project would not contribute to a measurable change in habitat quality and distribution across the SJNF.

J.4.2.7 Mountain Bluebird

The mountain bluebird is an obligate, secondary cavity nester that requires standing snags and green trees with heartwood decay for nesting substrate. A controlling factor for bluebird populations is the number and distribution of snags and standing green trees with heartwood rot. Reductions in snag density, especially near forest openings, recreation areas, roads, and meadows would result in reductions in bluebird habitat quality and possibly population density. Measures to minimize the loss of snags and replacement trees are included in this analysis.

J.4.2.7.1 Species Biology and Affected Environment

The mountain bluebird (*Sialia currucoides*) was selected as an MIS in the Forest Plan because it uses a "unique habitat that will monitor management practices." This project uses mountain bluebird as an indicator of effects on obligate, secondary, cavity-nesting birds. Species that occur in the Project Area and that are obligate, secondary cavity-nesters include American kestrel, flammulated owl, ash-throated flycatcher, three species of swallows, brown creeper, house wren, and western bluebird.

The breeding range of the mountain bluebird is limited to the western third of the North American continent and roughly corresponds to the mountainous portions of the continent and western Great Plains (Price et al. 1995). Bluebirds breed from southeastern and central Alaska south through Canada to southern California, Arizona, and New Mexico, but appear to avoid the immediate Pacific coast and the lowest and driest parts of the Great Basin and Southwestern Deserts.

They appear to reach their highest breeding abundance in the sagebrush shrublands of the central Rocky Mountains and intermountain West (Dobkin 1994).

Bluebirds winter primarily in the lower Great Plains, lower Colorado River valley, and lower-elevation deserts from southern Nevada, Utah, and Colorado south to northern Mexico. Bluebirds are only partially migratory: the birds that breed farthest north migrate to the southern U.S. and Mexico, whereas those that breed in more southerly latitudes often winter near their breeding areas, simply moving to lower elevations that are only short distances away (Hejl et al. 1995, Sibley 2001).

The mountain bluebird has no federal or state status (USFWS 2003, CDOW 2002). It has no global or state conservation status (CNHP 2002). It is protected under the Migratory Bird Treaty Act (APHIS 2002). The Partners in Flight Conservation Priority Scoring process gives it a score of 21 (of a maximum possible score of 35), using the Colorado population trend value from the North American BBS, and a score of 21, using the continental population trend value (Colorado Bird Observatory 1997). They will readily use artificial nest boxes placed in open habitats or near human habitation. They have high site fidelity and are relatively tolerant of human disturbance. During the breeding season, bluebirds feed primarily on insects captured on the ground or during short sally flights from an elevated perch (Sibley 2001).

Mountain bluebird population trend data from the BBS show a significant increase for the state of Colorado, the southern Rockies, and the continent since 1966, and a relatively stable, insignificant trend since 1980. BBS data for Colorado track bluebird population trends at gross geographic scales and long time intervals. Despite this, BBS data appear to represent accurately where bluebirds are thought to be most abundant in Colorado and the Southern Rockies, and bluebird populations appear stable throughout the state of Colorado, including the SJNF.

Audubon has coordinated CBCs annually across the United States and Canada since 1900. The trend in mountain bluebird detections has been stable (1959 to 1988) survey-wide, and for the states of Colorado and New Mexico. Similar to BBS data, CBC data are most appropriately used at large scales and long time intervals, and CBC data also appear to provide a reasonable representation of where bluebird are thought to be most abundant in winter. Given the qualitative agreement between CBC and BBS population trend data, it is reasonable to conclude that mountain bluebird populations are stable across southwestern Colorado, including the SJNF.

In Colorado, the mountain bluebird is widely distributed across the western two-thirds of the state in a wide variety of montane habitat types and in a wide range of elevations, up to about 10,000 feet. Their wide geographic and habitat range is reflected in the fact that only 15 species of birds were found in more priority blocks during the Colorado Breeding Bird Atlas project (Barrett 1998). The only substantial gap in the distribution of bluebirds in Colorado occurs in the San Luis Valley, where a lack of available cavity nest sites in agricultural areas may limit the population. They are considered to be both a migrant and summer resident in

foothills and mountains statewide, and a winter resident primarily in southern Colorado (Towry 1984, Andrews and Richter 1992).

Mountain bluebird breeding habitats include grasslands; sagebrush next to open, coniferous forests (especially ponderosa pine and piñon-juniper); aspen forests; spruce-fir adjacent to mountain parks; spruce-fir clear-cut harvest areas; Gambel oak; and mountain shrub (Towry 1987, Andrews and Righter 1992, Dobkin 1994, Hutto and Young 1999, Scriven 1999). There are two primary components of mountain bluebird habitat: tree cavities for nesting and open habitats for capturing prey on or near the ground.

Adult bluebirds are foraging generalists, feeding on a wide variety of invertebrates (90 percent) and berries, especially juniper berries during winter (Towry 1984, Ehrlich et al. 1988). Insect prey is captured on the ground after being pounced on from an elevated observation perch, a technique named "ground-sallying" (Sibley 2001). Therefore, the density of ground and low-shrub vegetation is an important factor in determining bluebird foraging access. Bluebirds will also occasionally take insects out of the air by hovering or hawking over grasslands or forest openings (Towry 1984). In piñon-juniper woodlands, bluebirds are thought to provide an important role in juniper seed dispersal, due to their frequent use of juniper berries as a winter food source.

Bluebirds are an obligate, secondary cavity nester because they are not capable of constructing their own nesting cavities. Rather, they use cavities, generally in large-diameter (more than 16 inches d.b.h.) trees, that have been excavated by other cavity-constructing species, such as hairy woodpeckers. On the SJNF, bluebird nests are most often found in piñon-juniper, ponderosa pine, spruce-fir, and aspen habitats. Bluebirds appear to prefer snags in conifer habitats, but frequently use green trees with heartwood decay in aspen habitats.

Most bluebird nests on the SJNF are near the edges of meadows, parks, or old clear-cut openings, or in stands with very open canopies. The mountain bluebird is generally found in more open habitats than the western bluebird, and is more closely associated with forest openings and edges. On the SJNF, however, these two bluebird species are often found nesting close to each other, especially where sage meadows are interspersed with open ponderosa pine stands.

On the SJNF, mountain bluebirds are a well-distributed and reasonably abundant breeding species on all three Ranger Districts. The Durango Bird Club lists mountain bluebird as common on the SJNF. The Colorado Breeding Bird Atlas confirmed bluebirds breeding in more than half of the priority blocks on the SJNF (Barrett 1998). Bluebirds are detected nearly every year on most BBS routes on the SJNF, and the Monitoring Colorado's Birds partnership (Leukering et al. 2000) has detected bluebirds on most of the transects conducted in suitable bluebird habitat on the SJNF.

Bluebirds rarely overwinter on the SJNF, except at the lowest elevations, due to the normal presence of consistent snow cover. Colorado Breeding Bird Atlas records show mountain bluebird is well distributed not only across the SJNF, but also well beyond the Forest's boundary throughout southwestern Colorado. Therefore, based on distribution and habitat maps and field experience, no evi-

dence has been found to suggest that individuals within the SJNF are an isolated or unique population for which there is a viability concern.

Within the Project Area on the SJNF, most of the sagebrush is fairly open, dominated by grasses and forbs, and occurs at lower elevations on the eastern and western slopes of the HD Mountains. It is most extensive on the west side, extending up into canyons and forming moderate-sized parks. This open-structured sage habitat is thought to be high-quality bluebird foraging habitat. The sagebrush shrublands, and the grasslands riparian and small forest openings, that are the primary bluebird foraging habitats are relatively widespread across the Project Area and comprise large acreages.

The most abundant habitat type within the Project Area that is used for nesting by bluebirds is ponderosa pine, with about 56 percent of this habitat type on the SJNF. The next most abundant habitat type is piñon-juniper, about 37 percent on SJNF. Mixed conifer is far less abundant than the previous habitat types, and 95 percent occurs on the SJNF. Most of the ponderosa pine on the SJNF portion of the Project Area is on gentle, lower slopes from 6,800 to 7,800 feet elevation, and on north-facing slopes.

On the SJNF, about 51 percent of the ponderosa pine and 18 percent of the piñon-juniper meet the criteria in the MIS habitat model for mountain bluebird nesting habitat. Most of the mixed conifer in the Project Area is at higher elevations on north-facing slopes. Aspen is uncommon in the Project Area and occurs mainly as stringers along intermittent drainages, or in a few stands on north slopes. Only very limited bluebird nesting habitat is found in aspen or mixed-conifer habitats in the Project Area, due to their more closed stand structures and very limited distributions.

On the SJNF in the past 10 years, there have been some timber harvest and controlled-burn activities in ponderosa pine in the Sauls Creek and Spring Creek areas and Lange and Bull Canyons. Snag density is lower in these areas than in unroaded ones or old-growth stands, thereby reducing bluebird nesting opportunities. Areas like Sauls Creek that receive heavy summer and fall recreation use also have reduced snag density. These same activities have also opened stand structures, however, in stands that may have otherwise been too dense for bluebirds, increasing bluebird foraging opportunities.

Mountain Bluebirds rely primarily on snags and green trees with heartwood decay for nesting. For this reason, we assume that a limiting factor on bluebird populations is the number and distribution of snags and standing green trees with heartwood rot. Reductions in snag density, especially near forest openings, recreation areas, roads, and meadows, should, therefore, result in reductions in bluebird habitat quality, and possibly population density.

At the scale of the entire SJNF, there are sufficient snags in piñon-juniper, aspen, mixed-conifer, and spruce-fir habitats to maintain viable populations of bluebirds. Snag density in ponderosa pine habitat is generally below Forest Plan guidelines in easily accessed areas, including some parts of the Project Area, although snag-density data across the entire ponderosa pine type are unavailable. Old-growth stands and remote, steep-sided canyons have been found to have

higher snag density than more accessible areas or areas with regular management activities.

The generally low pine snag density Forest-wide is attributable primarily to fuelwood cutting and past timber harvest practices. Because of concerns about low density of snags and green trees with heartwood decay in the ponderosa pine type, snags are protected during project activities, pine-restoration and other timber harvest treatments, and prescribed burns. In addition, cutting standing, dead ponderosa pine for fuelwood has been prohibited on the Dolores and Pagosa Ranger Districts. Given these measures, along with recent increases in mountain pine beetle activity in the ponderosa pine type on the SJNF, the density of snags and green trees with heartwood decay should increase in the near future, along with presumed amounts of bluebird nesting habitat.

Surveys for mountain bluebirds were conducted on SJNF land in the Project Area during summer 2003. These surveys targeted areas that the SJNF MIS habitat model predicted was bluebird nesting and foraging habitat. A total of 2,029 acres on 9 transects was surveyed and 17 bluebirds were detected. Using distance estimation techniques (Buckland et al. 1993), bluebird density was estimated at 0.037 birds per hectare (0.015 birds per acre). This density estimate is very similar to results from State-wide surveys (Leukering et al. 2002). State-wide surveys conducted in piñon-juniper habitat reported bluebird density of 0.075 birds per hectare. Additional, less formal inventories were conducted in the Pargin Mountain area between 2001 and 2003, and bluebirds were "observed throughout the area" (Clark 2003). Other surveys in the Pargin Mountain area during 2002 found that bluebirds "were present at all times of the year in the Project Area, and assumed to be breeding" (Black and Wood 2003).

Acreage of mountain bluebird nesting and foraging habitat was calculated based on the MIS habitat model. This model estimates there are 5,625 acres of bluebird nesting habitat and 10,105 acres of foraging habitat on SJNF land in the Project Area. Thus, there are 15,730 acres of bluebird habitat on SJNF land, about 32 percent of the SJNF land in the Project Area (Table J–7). There are 29,341 acres of bluebird nesting habitat and 30,554 acres of foraging habitat on all land in the Project Area, about 48 percent of the total land base in the Project Area (Table J–8). There are 284,100 acres of bluebird habitat in the SUIT EIS Study Area to the south of the Project Area, and therefore 343,995 acres of bluebird habitat in the Cumulative Effects Analysis Area (Table J–9).

Bluebird habitat is well distributed across the Project Area and on all ownerships. There is more foraging habitat in the western half of the Project Area on non-federal land, and more nesting habitat in larger, contiguous blocks in the eastern half on NFS land. Nesting and foraging habitats are closely intermixed and well distributed across the Project Area.

Towry (1984) estimated that 30 mountain bluebirds constitute a minimum viable population, requiring 120 acres of optimal habitat. Undoubtedly, the Project Area supports far more than 30 mountain bluebirds. Based on the bluebird density in the Project Area (0.015 birds per acre) and the estimated amount of bluebird habitat in the Project Area (59,895 acres), the Project Area is projected to support about 898 mountain bluebird pairs.

While this is not a statistical index, the Project Area clearly supports large numbers of bluebirds, well distributed across the available habitat. In addition, data from the SJNF and the Project Area on bluebird abundance and reproductive parameters such as clutch size, breeding success, timing of nesting, and diameter of cavity trees used for nesting are consistent with reports from the published literature, suggesting that bluebird populations on the SJNF and in the Project Area are viable, with a stable or increasing trend.

Data collected in part on the SJNF show that cavity-dependant species such as the mountain bluebird prefer the largest-diameter snags available, and that this preference is maintained as average stand diameters increase (Schultz 2001). This study found that the diameter of trees used by cavity-nesting birds greatly exceeds the definition of a snag that is used by the Forest Plan (FS 1992). The SJNF LMP defines a snag as "a dead tree that is free-standing, greater than 8 inches d.b.h., and at least 10 feet in height." All active nest-cavity snags located in this study (Schultz 2001) exceeded the diameter and height of the LMP snag definition. Although the average diameter of active cavity-nest trees in this study was 17.3 inches d.b.h, half of all cavity nests were found in trees that exceeded 21 inches d.b.h. In addition, the average diameter of active ponderosa pine cavity trees was 21.7 inches d.b.h. A study in Arizona (Rosenstock 1996) found that abundance of cavity-nesting birds increased with increasing proportion of large-diameter snags, increasing proportion of tall snags, and increasing snag density.

J.4.2.7.2 Direct and Indirect Effects

Varying amounts of mountain bluebird foraging and nesting habitat would be affected under each alternative (Table J–34).

Table J–34 Extent and Proportion of Affected Mountain Bluebird Habitat

	Alternative							Habitat Available (Acres)
	1	1A	1B	2	3	4	5	
NFS Land								
Forage Acres	215	127	83	414	122	132	14	5,625
Percent	3.8	2.3	1.5	7.4	2.2	2.3	0.2	
Nesting Acres	424	271	191	616	240	225	68	10,105
Percent	4.2	2.7	1.9	6.1	2.4	2.2	0.6	
Project Area								
Forage Acres	284	250	247	779	288	299	172	29,342
Percent	0.9	0.9	0.8	2.6	0.9	1.0	0.6	
Nesting Acres	495	341	269	771	312	298	134	30,554
Percent	1.6	1.1	0.9	2.5	1.0	1.0	0.4	

The extent of impacts on mountain bluebird would depend primarily on the number of wells drilled, the length of access roads to those wells, and the juxtaposition of infrastructure facilities to mountain bluebird habitat. Each acre of bluebird nesting habitat removed by the project would result in a relatively proportional gain of nearly one acre of foraging habitat. The loss of nesting habitat would be long term due to forest stand regeneration times, but the gain in bluebird foraging

habitat would be almost immediate (short term) with benefits continuing as long as the openings are maintained (long term). Loss of bluebird foraging habitat to infrastructure facility development would be short term because bluebirds readily forage around well pads and along road corridors and would use these areas soon after construction activities have ceased.

Table J–35 summarizes the magnitude of positive or negative impacts on mountain bluebird foraging and nesting habitat, and ranks alternatives from most to least impacting. The rankings displayed in Table J–35 are based on the percent of bluebird habitat lost under each alternative (Table J–34) and the juxtaposition of bluebird nesting and foraging habitat to proposed facilities. In general, the amount of habitat lost under all alternatives is relatively small (less than 3 percent), and effects of factors are moderate. Based on estimates of bluebird density and amount of bluebird habitat in the Project Area, implementing any of the proposed alternatives would result in a 0.9 percent to 1.4 percent decline in the potential of the Project Area to support mountain bluebirds. Thus, some individuals may be affected but none of the factors or alternatives are likely to cause a significant decline in bluebird populations.

Removal of mountain bluebird nesting habitat would create small gaps in previously continuous forest canopies. The primary effect of these gaps in bluebird nesting habitat is the direct loss of potential nesting sites. However, these gaps would also provide new foraging habitat as well as opportunities to access new nesting habitat that was not previously available to bluebirds because of distance from a forest opening. The small forest openings created by infrastructure sites and road corridors resemble the many openings that currently occur through out the area, and thus would provide new bluebird foraging opportunities while at the same time reducing bluebird nesting opportunities. Thus, the effect of these openings on bluebird nesting habitat (loss of habitat) is opposite the effect on bluebird foraging habitat (gain of habitat), but both effects would be long term because it would take decades after project completion before reclaimed project infrastructure sites return to forested stands capable of providing snags of sufficient diameter for bluebird nesting. The gain in bluebird foraging habitat would be short term because bluebirds would be able to take advantage of these new sites almost immediately after they are created.

The predicted acres of mountain bluebird nesting habitat lost to facility development under each of the alternatives are shown in Table J–34. Based on direct habitat loss, Alternative 2 is the most impacting to bluebird nesting habitat in both the short-term and long-term.

Based on direct habitat loss, the remaining alternatives would have relatively equal effect on bluebird nesting and foraging habitat. On both NFS land and within the entire Project Area, Alternatives 2 would be most extensive to foraging and nesting habitat, followed in descending order by Alternatives 1, 3, 1A, 1B, 4, and 5.

Table J–35 Relative Impacts on Mountain Bluebird by Alternative

Factor	Alternative						
	Alt. 1	Alt. 1A	Alt. 1B	Alt. 2	Alt. 3	Alt. 4	Alt. 5
Direct habitat loss							
Magnitude and Type of Effects[1]	Mod–	Mod–	Mod–	Mod–	Mod–	Mod–	Mod–
Ranking of Alternatives[2]	6	4	3	7	5	2	1
Home range shift and displacement							
Magnitude and Type of Effects	Mod–	Mod–	Mod–	Mod–	Mod–	Mod–	Mod–
Ranking of Alternatives	6	4	3	7	5	2	1
Habitat fragmentation							
Magnitude and Type of Effects	Minor–	Minor–	Minor–	Minor–	Minor–	Minor–	Minor–
Ranking of Alternatives	6	4	3	7	5	2	1
Increased vulnerability to predators/ vehicle collision							
Magnitude and Type of Effects	Mod–	Mod–	Mod–	Mod–	Mod–	Mod–	Mod–
Ranking of Alternatives	6	4	3	7	5	2	1
Facilities-related mortality							
Magnitude and Type of Effects	None	None	None	None	None	None	None
Ranking of Alternatives	None	None	None	None	None	None	None
Recreation							
Magnitude and Type of Effects	Mod+	Mod+	Mod+	Mod+	Mod+	Mod+	None
Ranking of Alternatives	6	4	3	7	5	2	1
Noise							
Magnitude and Type of Effects	Mod–	Mod–	Mod–	Mod–	Mod–	Mod–	Mod–
Ranking of Alternatives	6	4	3	7	5	2	1
Development activity							
Magnitude and Type of Effects	Mod–	Mod–	Mod–	Mod–	Mod–	Mod–	Mod–
Ranking of Alternatives	6	4	3	7	5	2	1
Production activity							
Magnitude and Type of Effects	Minor–	Minor–	Minor–	Minor–	Minor–	Minor–	Minor–
Ranking of Alternatives	6	4	3	7	5	2	1

Notes:
1. None = immeasurable effect or compensating adverse and beneficial effects, Minor = individuals not likely affected, Mod = (moderate) individuals may be affected but populations would not be affected, "–" = negative effect, "+" = positive effect. Thus, Mod– is a moderate negative effect.
2. Rankings are in order from the least impact (1) to the greatest impact (7).

The estimate of mountain bluebird density in the Project Area (0.015 birds per acre) was used to calculate an index of the effect of habitat loss on individual birds. This index is used to compare the effects of the alternatives on individual birds. The most extensive alternative (Alternative 2) results in the loss of 779 acres of bluebird foraging habitat and 771 acres of nesting habitat in the Project Area, which has the potential to support 23 bluebirds. The least extensive alternative (Alternative 5) results in the loss of 172 acres of bluebird foraging habitat and 134 acres of nesting habitat in the Project Area, which has the potential to support 5 bluebirds. In contrast, the Project Area has 59,896 acres of modeled bluebird habitat, which has the potential to support 898 bluebirds. Thus, the alternatives would result in a 0.5-percent to 2.5-percent decline in the potential of the Project Area to support mountain bluebirds.

There would be some additional and long-term direct loss of bluebird nesting habitat due to fuels reduction projects and fire protection activities around project

facilities. Fuels reduction projects have been conducted on the SJNF portion of the Project Area for many years, and would likely increase over the immediate future. These projects often target removal of understory, dead and dying trees that are nesting sites for bluebirds. Unless efforts are taken to protect large-diameter (greater than 16 inch d.b.h.) snags, they may be lost to controlled burns and thus result in declining habitat quality for primary cavity excavators (such as woodpeckers) and secondary cavity nesters (such as bluebirds). Although fuels reduction projects often kill smaller understory trees they are rarely allowed to burn hot enough to create snags out of the larger overstory trees that have sufficient diameter (greater than 9 inches d.b.h.) for nest cavity construction. Despite the loss of some nesting habitat, these same actions would improve bluebird foraging habitat by creating openings in the forest canopy, opening up the forest understory, removing shrub cover and providing better access to the forest floor.

Some shift in home range or displacement of individual birds would occur where roads, facilities, pipelines or other infrastructure developments intersect bluebird nesting habitat, but would not necessarily occur where bluebird foraging habitat is intersected. Displacement may occur due to direct loss of nesting habitat or due to a reaction of individual birds to higher levels of human activity during the construction (short term) and production (long term) phases. The degree to which this factor would affect mountain bluebirds would depend on the duration of construction, amount of disturbance caused by operating facilities and service visits, loss of key habitat components (i.e. snags), and tolerance of individual birds to disturbance. Disturbed sites that are quickly re-seeded and re-vegetated with native vegetation after facility construction would benefit bluebirds by providing higher quality foraging areas than would have otherwise existed if the sites were left to re-generate naturally. Given the large amount of nesting and foraging habitat and its well distributed nature in the Project Area, some individuals may be affected by home range shift and displacement but it is unlikely to result in a population decline. Therefore, the magnitude of impact of this factor to bluebirds is moderate and negative.

Some fragmentation of bluebird nesting habitat would occur under all alternatives as infrastructure is constructed in ponderosa pine stands. However, abundant bluebird nesting habitat would remain adjacent to disturbed areas and connected to other blocks of nesting habitat. Newly constructed roads and infrastructure sites would not create barriers to bluebird movements or dispersal or create isolated habitat from forested stands. These openings may reduce the number of available nesting cavities thereby reducing bluebird nesting opportunities in some individual stands, but they would also create new foraging opportunities that may not have existed in formerly densely stocked forest stands. Given the large amounts and interconnected nature of ponderosa pine stands on the SJNF portion of the Project Area, fragmentation of a few nesting stands is unlikely to cause a bluebird population decline. Therefore, the magnitude of impact of this factor to bluebirds is moderate and the effect is negative.

As new openings are created by well pad and road construction, individual bluebirds may become more vulnerable to vehicle collisions or predators. However, bluebirds are rarely found dead along heavily traveled road corridors in southwestern Colorado despite their often-close proximity to highways. They are attracted to roadside habitats because the maintenance of grasslands along road

edges provides clear access to insects on the ground. Most new roads would be gated and closed to public motorized travel and therefore receive relatively low traffic volumes. Vehicle speeds would also be low due to design, terrain and travel management restrictions. Given the low volume and speed of traffic expected on new roads in the Project Area, and the lack of bluebird mortality on much heavier traveled county roads in this area, the potential for the alternatives to increase vulnerability of bluebirds to vehicle collisions is small.

Mammalian predators would be attracted to facility infrastructure and road corridors as human activity increases, and therefore losses of bluebird nests near these facilities may increase. However, birds that nest in tree cavities have much lower nest predation rates than open cup nesting birds due to the difficulty most predators have in reaching their nests. For these reasons, a few individual bluebirds may be affected, but populations would not be impacted. Therefore, the magnitude of impact of this factor to bluebirds is moderate and the effect is negative.

Facility-related mortality is possible. However, while bluebird mortality may occur at project facilities from exposure to mechanical or toxic substances, mitigation measures render the possibility remote. Use of storage tanks, or mesh or other coverings over gray water storage pits would prevent exposure to this source of toxic risk while bluebirds are foraging on the ground in and around operating facilities. Because there is a remote (i.e. un-measurable) risk to individual birds, the magnitude of impact of this factor to bluebirds is determined to be no effect.

The impact of non-motorized recreation (foot, bike, and horse) on mountain bluebirds is generally small because bluebirds nest in tree cavities and are relatively tolerant of human activities. As described previously, bluebirds in the Project Area commonly nest and forage along roadways and in close proximity to houses, farm outbuildings and sometimes actually on farm and ranch equipment. Although some increase in the amount of motorized and non-motorized recreation along roads and trails in the SJNF portion of the Project Area may be possible under all alternatives, bluebirds are less sensitive to disturbance than many other birds. New roads would open foot and horseback access to previously lightly utilized portions of the Project Area but bluebirds are tolerant of short duration disturbance associated with dispersed recreational activities. Motorized and non-motorized recreation could result in some short distance displacement of individual bluebirds to adjacent habitat within their home range or a change in behavior that temporarily disrupts activity.

OHVs are currently permitted off-road through out the SJNF portion of the Project Area. Alternatives 1 through 3's change travel management that restrict motorized travel to some existing roads and designated trails would benefit mountain bluebirds because it would restrict vehicle access from many areas of bluebird foraging habitat formerly accessed by OHVs. Vehicles often reduce the quality of bluebird foraging habitat by trampling meadow grasses, compacting soils, creating erosion, and introducing non-native plants that compete with native species; all factors that can reduce the abundance and diversity of the native ground-dwelling insects that are bluebird's primary prey. Because motorized travel would be restricted to service and official business purposes only, motor-

ized recreational use of new roads would not reduce bluebird foraging habitat quality.

The other potential impact of recreation activities on mountain bluebirds is the loss of snags to camping and personal use fuelwood cutting. The limiting factor on mountain bluebird populations is the number and distribution of snags and standing green trees with heartwood rot (Hejl 1994). Reductions in snag density would result in reductions in bluebird nesting habitat quality. Snag densities in ponderosa pine habitat are generally below Forest Plan standards and guidelines in easily accessed areas, including some parts of the Project Area. Although some additional reductions in snag density would occur in localized areas as this project is implemented, the large amounts and interconnected nature of ponderosa pine stands on the SJNF portion of the Project Area would prevent widespread bluebird population declines. Travel management restrictions would also protect snags along project roads, thereby protecting the key bluebird nesting habitat component. Because individual bluebirds would be affected by recreational activities but populations would not be affected, the magnitude of impact of this factor to bluebirds is moderate, and the effect is negative.

Noise levels associated with development and production activities are expected to have both short and long-term effects. However, some habituation to consistent and predictable noise sources would occur for many wildlife species including mountain bluebirds, reducing the loss of habitat effectiveness as they adjust to these noise sources.

Increased human presence, traffic, construction, and production noise at project facilities would influence bluebird habitat use and reduce habitat effectiveness adjacent to facility sites to some degree for the short and long term. However, these impacts are difficult to quantify because they depend on several factors including sensitivity of individual birds and availability and suitability of undisturbed habitats nearby. No formal studies have been conducted on the effect of disturbance or noise on bluebirds, but studies of other bird species in more open and heavily used habitats have shown significant reductions in habitat effectiveness in disturbed areas. As stated previously, bluebirds are relatively tolerant of human activities and commonly forage and nest in close proximity to areas of high human activity. Thus noise would likely have some impact, but it is not known how far away from facilities that zone of impact might extend. Probably some reduction in habitat effectiveness would occur and some individuals would be affected. However, given the large amount of occupied bluebird habitat and its wide distribution across the Project Area, noise is unlikely to reduce bluebird populations. Thus, the magnitude of impact of this factor to bluebirds is moderate and negative.

The noise produced by project construction activities that coincide with the bluebird-nesting season (early April through mid July in the Project Area) would affect some individual bluebirds nesting in close proximity to construction areas, but at any given location the effect would be short and temporary in duration. Given the large amounts and interconnected nature of bluebird nesting habitat across the Project Area, this activity is not likely to cause a bluebird population decline. Therefore, the magnitude of impact of this factor to bluebirds is moderate and negative.

Production impacts are expected to be lower than the impacts associated with project construction. In most cases, production activity is limited to one pickup truck visit of 5 to 20 minute duration per day to each well pad site for equipment monitoring purposes. Sites with telemetry would be visited much less often. Compressor stations would be visited more often, for longer periods of time, and by larger class vehicles. Most of this activity is routine in nature, is predictable and regular in pattern, and therefore most wildlife species quickly habituate to it. Bluebirds are relatively tolerant of human activities and commonly forage and nest in close proximity to areas of high human activity and therefore are not likely to be affected by routine production activities. Because individual bluebirds are unlikely to be affected by production activities, the magnitude of impact of this factor to bluebirds is minor but negative.

J.4.2.7.3 Cumulative Effects

The past, present, and reasonably foreseeable cumulative effects on mountain bluebird nesting and foraging habitat are given in Table J–36.

Table J–36 Extent and Proportion of Cumulative Effects on Mountain Bluebird Habitat

	Existing Effects	Alternative							Habitat Available (acres)
		1	1A	1B	2	3	4	5	
NFS land									
Forage Acres	19	215	127	83	414	122	132	14	5,625
Percent	0.3	3.8	2.3	1.5	7.4	2.2	2.3	0.2	
Nesting Acres	19	424	271	191	616	240	225	68	10,105
Percent	0.2	4.2	2.7	1.9	6.1	2.4	2.2	0.6	
Cumulative Effects Analysis Area									
Forage Acres	3,746	3,980	3,892	3,948	4,179	3,887	3,897	3,779	139,209
Percent	2.7	2.9	2.9	2.9	3.0	2.8	2.8	2.7	
Nesting Acres	3,746	4,189	4,036	3,956	4,381	4,005	3,990	3,833	144,891
Percent	2.6	2.9	2.8	2.7	3.0	2.8	2.8	2.7	

Habitat loss associated with oil and gas development throughout the cumulative effects area is low even for the most extensive alternative (Alternative 2, 3.0-percent foraging habitat loss). Additional factors of concern that may affect mountain bluebird populations and their habitat include timber harvesting, forest restoration, fuels reduction and fire suppression, grazing, road building, agricultural development, rural development, and recreation. These activities have altered the amount, distribution, and suitability (both positive and negative) of bluebird nesting and foraging habitat beyond the cumulative loss associated with oil and gas development shown in Table J–36. For example, timber harvest over the past 60 years has converted 1,535 acres of ponderosa pine forest on NFS land within the Project Area to other vegetation types, primarily Gambel oak, resulting in a net loss of available bluebird nesting habitat. The stand structure of another 4,960 acres of ponderosa pine has been altered by timber harvest during this same period. The effects of these timber harvests on bluebird habitat are likely both negative (loss of large-diameter snags and replacement trees) and positive (stand improvement harvests designed to promote more clumps of larger

trees and reduce stand stocking rates thereby improving foraging habitat and access to potential nesting stands).

Other factors that affect bluebird populations and habitat include nest site availability, food availability, perch sites, and weather. As an obligate secondary cavity nester, mountain bluebirds depend on existing cavities in standing snags. The presence and density of snags that are suitable for the construction of nest cavities may determine bluebird-breeding density. Extensive harvesting of large-diameter ponderosa pine in the early- to mid-1900s on the SJNF substantially reduced the availability of standing snags, live cavity trees, and snag replacement trees in this habitat type. Changes in timber harvest practices since 1983 and protection of large-diameter pine snags and replacement trees in managed stands has prevented further loss of habitat capability for cavity-nesting birds. No specific survey data regarding the change in snag density on other jurisdictions are available; but it is probable that snag density have decreased on private land in association with increased development. Snag trees within proximity to homes are typically treated as hazards and are removed.

Grazing practices that have caused gradual shifts of native grass dominated ranges to ranges dominated by shrub and non-native grasses, have reduced the diversity, abundance and availability of insect prey to ground foraging birds such as the mountain bluebird. Grazing-related conversion of grassland types in sagebrush habitats and expansion of Gambel oak in ponderosa pine woodlands occurred on substantial portions of the SJNF during the late 1800s and early- to mid-1900s. These changes significantly reduced the quality of bluebird foraging habitat. Dramatic reductions in livestock herd numbers occurred by the mid-1900s, and coupled with substantial improvements in grazing management practices, range conditions have improved across the Forest resulting in substantial improvements in bluebird foraging habitat since the mid-1900s and continued gradual improvement since 1983.

Because the preferred foraging technique of mountain bluebirds is ground-sallying (Sibley 2001), elevated perches within and adjacent to open habitats are important bluebird habitat components. The placement of fence posts across meadows and grasslands has significantly increased the availability of hunting perches to bluebirds thereby increasing the amount of foraging habitat available to bluebirds. Thus, fencing has significantly increased bluebird foraging opportunities on the SJNF and elsewhere in the cumulative effects area. As human development continues to expand in the area, fencing around residential areas is also likely to increase thereby increasing bluebird foraging habitat quality.

Fire suppression has changed the structure of ponderosa pine and pinyon-juniper woodlands over the past 100 years. Consequently, fire frequency has decreased, fire intensity has increased, and forest structure has changed dramatically. In general, fire suppression has increased the density of ponderosa pine stands on the SJNF and BLM portions of the Project Area and Southern Ute Tribal land. Pine stands on these ownerships have become more densely stocked with smaller diameter trees; have more uniform stand structures and more closed canopies, and have expanded and more mature oak understories (Romme et al. 1998) resulting in a loss of bluebird foraging habitat (Hejl et al. 1995). Increased pine stand density have resulted in greater mortality of small diameter trees, but the

reduction in trees in the largest diameter classes (greater than 16 inches d.b.h.) has reduced the availability of preferred cavity construction substrate. Local hairy woodpecker populations fluctuate in response to insect infestations particularly after fire (Andrews and Righter 1992). Thus, across the cumulative effects area, fire suppression has reduced a source of seasonally abundant food for bluebird that may have been abundant in some years following natural wild fires. As pine stands have become denser due to fire suppression, bluebird foraging habitat has also declined.

On non-Federal land, past agricultural and residential development and associated road construction and fire suppression activities have probably caused a loss of ponderosa pine and expansion of shrub, pinyon-juniper and grassland habitats, thereby reducing the amount of bluebird nesting habitat in the Project Area and cumulative effects area. While the extent of residential development is unknown, this increase has been widespread and continual through out the area, and has likely reduced bluebird-nesting habitat to a much greater extent than CBM development. However, bluebird foraging habitat has increased as human habitation has opened up formerly more dense habitat patches thus in some areas where nest cavities remain bluebirds have increased in abundance. Anticipated continued human population growth in the cumulative effects area suggests that bluebird-nesting habitat would continue to decline and foraging habitat would continue to increase, particularly in the western portion of the Project Area. Other activities that occur in the cumulative effects area that affect bluebird nesting and foraging habitat include continued fire suppression, grazing and timber harvest. These activities would have both positive and negative effects on bluebird habitat, distribution, and populations over the short and long term, but a quantitative prediction of the combined effect of these activities is difficult beyond site-specific examples. Qualitatively however, continued fuels reduction, fire suppression, timber harvest, grazing, oil and gas and urban development activities are likely to gradually reduce the amount of bluebird nesting habitat and increase the amount of bluebird foraging habitat in the cumulative effects area. However, unless the scope of these activities changes significantly in the future, these activities are not likely to change the overall distribution of mountain bluebirds or their nesting or foraging habitat across the area.

Other cumulative effects, such as reduced habitat effectiveness and habitat fragmentation, are not quantifiable due to lack of applicable studies. These impacts on public and tribal land are mostly attributable to oil and gas development, road construction and fire management programs. On private land, residential development and associated habitat management activities are the major factors affecting bluebird nesting and foraging habitat and populations. Compared to the effects of these activities, the proposed project would have only a slight influence on bluebird abundance and no effect on bluebird distribution across the cumulative effects area, even if the most extensive alternative is chosen.

The same factors of concern that have reduced mountain bluebird populations in the past would continue to shape future bluebird population and habitat trends. Moderate levels of timber harvest and prescribed burning would continue on the SJNF, BLM, and Southern Ute Tribal land with methods designed to promote more open stand characteristics thereby improving bluebird foraging habitat. Measures to protect ponderosa pine snags and snag replacement trees would also

continue on these lands and likely prevent further reductions of bluebird nesting habitat. In addition, grazing practices on the SJNF would continue to promote improved range condition and therefore improved bluebird foraging habitat.

J.4.2.7.4 Relationship of Project Effects to Forest-wide Population and Habitat Trends

This section tiers to Forest-wide MIS Assessment, and evaluates how implementation of the proposed project would contribute to mountain bluebird population and habitat trends across the entire SJNF. Mountain bluebird populations are currently stable or increasing and well distributed continuously across the SJNF and well beyond the SJNF's administrative boundary throughout southwestern Colorado. Bluebird density in the Project Area is similar to estimates from statewide surveys and no evidence has been found to suggest that individuals within the SJNF constitute an isolated or unique population for which there is a viability concern. The alternatives would result in a 0.5-percent to 2.5-percent decline in the potential of the Project Area to support bluebirds, and a 0.05-percent to 0.09-percent decline in the potential of the entire SJNF to support bluebirds. Thus, the proposed alternatives contribute negligibly to the SJNF's stable or increasing 20-year bluebird population trend, and would not affect the current well-distributed nature of bluebirds across the Forest or connectedness with populations on other nearby land ownerships. The project would not compromise population or long-term bluebird population trend across the SJNF.

The Forest-wide trend in mountain bluebird nesting and foraging habitat since 1983 was downward by 0.4-percent and 3.1-percent respectively over the 20-year analysis period. Bluebird nesting habitat has been stable on the SJNF for the past 20 years, and the most extensive alternative would alter the stable Forest-wide trend by only .04-percent. Similarly, the most extensive alternative would increase the bluebird foraging habitat rate of decline by only 0.16-percent, which negligibly impacts the SJNF-wide rate of bluebird habitat change. Thus, the alternatives would negligibly influence the overall SJNF-wide rate of change of mountain bluebird habitat. The SJNF would continue to provide habitat to support current populations of hairy woodpecker and the habitat would be well distributed so that individuals can interact with others in the planning area. The project would not contribute to a measurable change in habitat quality and distribution across the SJNF.

J.4.2.8 Mule Deer

Portions of the SJNF Terrestrial Wildlife MIS Assessment for mule deer were used in this assessment. The MIS Assessment provides more detailed information on species natural history, distribution, and preferred habitats and habitat and population trends on the SJNF. The assessment of mule deer habitat impact presented below is based on the habitat model presented in the mule deer chapter of the SJNF MIS assessment.

J.4.2.8.1 Species Biology and Affected Environment

Mule deer (*Odocoileus hemionus*) occupy all ecosystems in Colorado, from grasslands to alpine tundra. They reach their greatest density in shrublands on rough, broken terrain, which provide abundant browse and cover (Fitzgerald et al. 1994). Throughout Colorado, spring and summer ranges are typically mosaics

of meadows, aspen woodlands, alpine tundra-subalpine forest edges, or montane forest edges. Montane forest and piñon-juniper woodlands with good shrub understory are favored winter ranges (Fitzgerald et al. 1994). This is true also on the SJNF.

As described by Towry (1984) mule deer have three broad habitat requirements: (1) rearing, (2) feeding, and (3) cover. Rearing sites are often in the same general area year after year. These fawning sites can occur in any forest cover type on gentle slopes, given that hiding cover and water are in close proximity. Rearing requirements are important during a very brief period in the spring on summer range.

A wide distribution and general adaptability make for a broad diet. Mule deer select from many plant species that are in an early-successional stage of development. They are not "browsers" or "grazers" in the pure sense, but rather intermediate foragers of shrubs, grasses, and forbs (Towry 1984). Diets vary, with the proportion of shrubs, grasses, and forbs shifting throughout the year. Studies in Colorado have indicated that diets containing 30 percent or more sagebrush and juniper reduce rumen microbes and are, therefore, deleterious (Nagy and Tengerdy 1967, Schwartz et al. 1980). When heavy snows bury grasses and forbs and force mule deer to consume high amounts of sage and juniper, mortality rates increase, due to malnutrition (Fitzgerald et al. 1994).

Considering only habitat requirements, feeding habitat is often identified as the limiting factor for population size. Usually this habitat is winter range, but summer range also plays a role. The effective use of feeding habitat also depends on the nearby availability of cover. Cover, as defined by Thomas et al. (1979) and as applies to this discussion, is "vegetation used by wildlife for protection from predators, or to ameliorate conditions of weather, or in which to reproduce; also a shortened version of 'crown cover'". Cover can be either for hiding or for thermal regulation.

Deer are more abundant in the Project Area year-round than elk, but their seasonal ranges and migration patterns are similar. As described for elk, the Project Area and surrounding land are most important to deer as winter range. The area, particularly lower elevations on the western side, is winter habitat not only for resident deer, but also large numbers of deer that summer in the high country north of U.S. Highway 160 and migrate into the area each November-December. The HD Mountains represent an important deer winter range that supports moderate to heavy use. More deer are present in the area during winter than summer, and more deer winter on the western slope of the mountains than on the east side.

CDOW polygons of mule deer winter range, severe-winter range, and winter concentration areas are similar to but more limited than those for elk (Figure J–2 and Table J–37). Winter range generally is below 7,400 feet east of the HD Mountains and 7,600 feet on the west side. Deer cannot negotiate deep snows as easily as elk, however, so deer often winter at slightly lower elevations (or in areas with shallower snows), particularly during harsh winters. Severe-winter range and winter concentration areas occur at lower elevations of the overall winter habitat. Severe-winter range exists only within roughly one mile of the Piedra River on the east side of the Project Area, but is widespread on the west side.

Deer migration to and from these winter ranges typically occurs from about three weeks before fall elk migration until just after spring elk migration. The entire Project Area is summer range for mule deer, although the lower-elevation, Forest/private interface supports a large number of resident deer.

Table J–37 Distribution of Mule Deer Ranges

Range	NFS land (acres)	Portion of NFS Land (percent)	Project Area (acres)	Portion of Project Area (percent)	Cumulative Effects Analysis Area (acres)	Portion of Cumulative Effects Analysis Area (percent)
Winter Range	16,665	34	43,036	34	196,291	36
Winter Concentration Area	0	0	17,758	14	183,707	34
Severe-Winter Range	8,269	22	38,105	30	110,151	20
Total	24,934	51	98,899	79	490,149	90

There are 391,000 acres of deer habitat in the SUIT EIS Study Area south of the Project Area and, therefore, 490,000 acres of habitat in the cumulative effects analysis area.

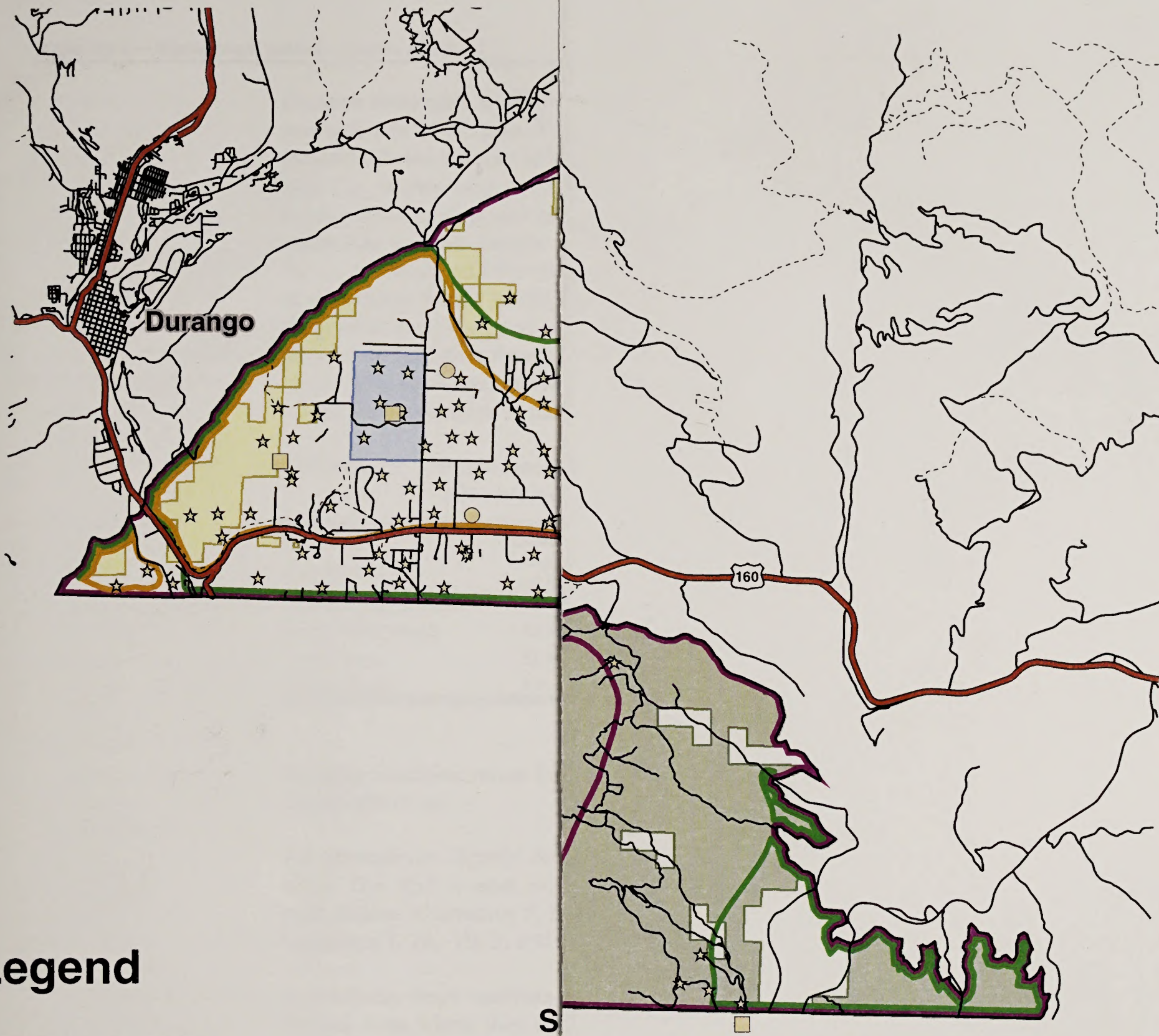
Deer management in the HD Mountains is typical of most rural districts in Colorado. The general effect of hunting is that deer are pushed to unhunted areas. Most of the Project Area is within DAU D–30. (Less than one percent of the Project Area, on the extreme western end near Durango, is in DAU D–52 and will not be addressed in this analysis.) DAU D–30 encompasses approximately the east half of the SJNF, which includes all of the Pagosa Ranger District and the east half of the Columbine Ranger District.

In 2001 the DAU D–30 mule deer population was estimated to be 19,407 individuals. In 2002 about 50 percent of that population wintered in the Project Area; over the last six winters, that percentage ranged from 41 to 63 percent (Wait 2003). On average, the Project Area supports about 10,000 winter mule deer, a significant portion of the entire DAU population.

Mule deer have no federal listing status (USFWS 2002). The Forest Plan identifies mule deer as an early-successional MIS, and CDOW manages them as a big-game species.

J.4.2.8.2 Direct and Indirect Effects

Direct effects are those attributed to loss of habitat through road, well pad, and facilities during the initial construction phase. Indirect effects are those associated with a loss of habitat effectiveness due to changes in human access that could behaviorally affect animals during the project's production phase.



Legend

Existing Facilities

- Compressor
- Disposal Well
- Fruitland Well
- Non-Fruitland Well

Existing Roads

- Highway
- Secondary
- Trail Open to Motorized Use

S

M

NORTHERN SAN JUAN BASIN CBM EIS

FIGURE J-2
MULE DEER RANGES

ANALYSIS AREA: LA PLATA & ARCHULETA COUNTIES, COLORADO	
Date: 04/01/04	File: I:\994\..\muledeer_maps.mxd
	Drawn By: MSH

Deer migration to and from these winter ranges typically occurs from about three weeks before fall elk migration until just after spring elk migration. The entire Project Area is summer range for mule deer, although the lower-elevation, Forest/private interface supports a large number of resident deer.

Table J–37 Distribution of Mule Deer Ranges

Range	NFS land (acres)	Portion of NFS Land (percent)	Project Area (acres)	Portion of Project Area (percent)	Cumulative Effects Analysis Area (acres)	Portion of Cumulative Effects Analysis Area (percent)
Winter Range	16,665	34	43,036	34	196,291	36
Winter Concentration Area	0	0	17,758	14	183,707	34
Severe-Winter Range	8,269	22	38,105	30	110,151	20
Total	24,934	51	98,899	79	490,149	90

There are 391,000 acres of deer habitat in the SUIT EIS Study Area south of the Project Area and, therefore, 490,000 acres of habitat in the cumulative effects analysis area.

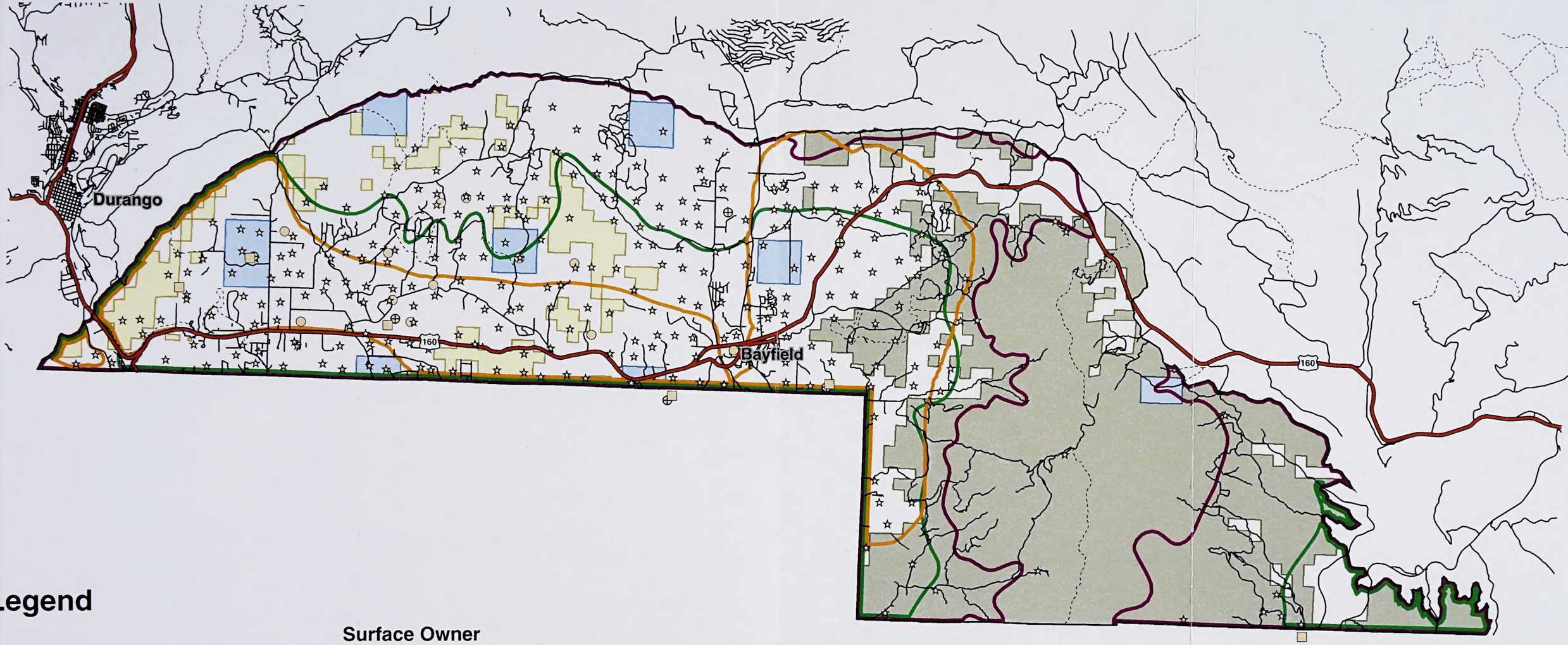
Deer management in the HD Mountains is typical of most rural districts in Colorado. The general effect of hunting is that deer are pushed to unhunted areas. Most of the Project Area is within DAU D–30. (Less than one percent of the Project Area, on the extreme western end near Durango, is in DAU D–52 and will not be addressed in this analysis.) DAU D–30 encompasses approximately the east half of the SJNF, which includes all of the Pagosa Ranger District and the east half of the Columbine Ranger District.

In 2001 the DAU D–30 mule deer population was estimated to be 19,407 individuals. In 2002 about 50 percent of that population wintered in the Project Area; over the last six winters, that percentage ranged from 41 to 63 percent (Wait 2003). On average, the Project Area supports about 10,000 winter mule deer, a significant portion of the entire DAU population.

Mule deer have no federal listing status (USFWS 2002). The Forest Plan identifies mule deer as an early-successional MIS, and CDOW manages them as a big-game species.

J.4.2.8.2 Direct and Indirect Effects

Direct effects are those attributed to loss of habitat through road, well pad, and facilities during the initial construction phase. Indirect effects are those associated with a loss of habitat effectiveness due to changes in human access that could behaviorally affect animals during the project's production phase.



Legend

Existing Facilities

- Compressor
- Disposal Well
- Fruitland Well
- Non-Fruitland Well

Existing Roads

- Highway
- Secondary
- Trail Open to Motorized Use

Surface Owner

- BLM
- STATE
- USFS

Mule Deer Range

- Winter Concentration Area
- Winter Range
- Severe Winter Range

N W E S

0 1 2 4 6 8 Miles

0 1 2 4 6 8 10 Kilometers

NORTHERN SAN JUAN BASIN CBM EIS

FIGURE J-2
MULE DEER RANGES

ANALYSIS AREA: LA PLATA & ARCHULETA COUNTIES, COLORADO

Date: 04/01/04	File: I:\994\..\muledeer_maps.mxd
	Drawn By: MSH

Because mule deer are habitat generalists, shifts in habitat types normally do not preclude use of an area. For this reason the suitability of mule deer habitat is measured in the amount of forage relative to the amount of cover in a given range type (i.e. winter range). As defined by Thomas (1979) "optimum deer and elk habitat is the amount and arrangement of cover and forage areas that result in the maximum possible proper use of the maximum possible area by the animals." Again, as described I the elk assessment, in the Blue Mountains of Oregon a ratio of 60-percent forage to 40-percent cover is optimum. This ratio has been widely adopted in many forested elk and deer habitats across western states. Table J–38 displays the existing forage to cover ratio on NFS lands and the ratio that would result from each alternative. Forage and cover information is not available on other land ownerships in the Project Area.

Table J–38 Mule Deer, Forage to Cover Ratios by Range Type for Each Alternative on NFS Land

Mule Deer Range	Existing Forage to Cover Ratio	Cumulative Effects						
		Alt. 1	Alt. 1A	Alt. 1B	Alt. 2	Alt. 3	Alt. 4	Alt. 5
Winter Concentration Area	60:40	61:39	61:39	61:39	62:38	61:39	61:39	60:40
Severe Winter Range	62:38	63:37	63:37	63:37	64:36	63:37	63:37	62:38
Winter Range	52:48	53:47	53:47	53:47	54:46	53:47	53:47	52:48
Summer Range	59:41	60:40	60:40	59:41	60:40	59:41	59:41	59:41

Existing condition ratios for all ranges are near optimum of 60 percent forage to 40 percent cover.

All alternatives slightly decrease cover, moving the ratio away from the optimum. This shift is most evident in Alternative 2 where cover decreases by 2 percent. Under Alternative 5, there is no measurable change in forage to cover. Alternatives 1, 1A, 1B, 3, and 4 would result in similar slight decreases in cover.

A relatively large numbers of elk and deer concentrate on winter ranges in the Project Area where they are sensitive to chronic and acute human disturbances. Habitat effectiveness (Lyon 1979) is the degree to which habitat adjacent to roads or human activity areas are less than fully utilized because animals are avoiding the associated activities. Vehicular use of roads adversely affects elk use of adjacent habitats (Burbridge and Neff 1976, Hershey and Leege 1976, Leege 1976, Marcum 1976, Perry and Overly 1976, Ward 1975, Ward et al.1976, Hinschberger et al. 1978, Lyon 1979, Rost and Bailey 1979, and Johnson and Lockman 1981, Johnson et al. 1990).

Road access on NFS Project lands is managed for 'summer' recreational use and 'winter' big-game range. Thus, during summer there is a higher effective road density than winter. The general hunting season occurs during this summer season and the greatest human disturbance occurs at this time. During winter most NFS roads are gated with access granted to industry maintenance personnel only. NFS roads that provide access to private land are open during the winter. Any newly constructed road would be gated year-round and would receive only industry-associated activities.

Table J–39 lists total road and motorized trail densities that currently exist and those that could result from each alternative. Road densities listed represent year round conditions except for NFS lands, where roads are open or closed depending upon time of year. Roads that would receive any authorized use were included in density calculations even though the use of those roads would be very light

In general, Forest Plan direction for the national forest portion of the Project Area specifies an open road density no greater than one mile of road per square mile. Existing road densities on NFS winter range are within the 1.0-miles/square mile maximum. With the exception of Alternative 5, all alternatives would add road densities that exceed the 1.0-miles/square mile maximum by about 0.5 miles/square mile to 2.5 miles/square mile. Winter concentration area, severe winter range, and winter range road densities listed in Table J–39 for NFS lands.

BLM and State owned lands within the Project Area are gated year-round with road access granted only to industry. Existing summer road densities are relatively low, 0.4-miles/square mile and 1.4-miles/square mile respectively. BLM road density would increase by about 0.25-miles/square mile for each alternative with the exception of Alternative 2 where it would increase by about 0.5-miles/square mile. State road densities increase by the same amount for all alternatives except Alternative 2 where there is a 0.25 mile/square mile increase.

Private land generally has the most unrestricted access. Most roads on private land are open year round and receive constant use. There would be an increase in summer road densities from the existing 1.8 miles/square mile for all alternatives. The largest increase would occur under Alternative 2 where the overall density would increase by about 0.75 miles/square mile.

Habitat management guidelines for northern Idaho predict 10 to 70 percent reductions in elk use within 0.25 miles of open roads (Interagency Study Team 1977). One-quarter mile is the distance most commonly used to assess the influence of proposed secondary roads, open to the public, on elk habitat effectiveness. This zone of disturbance may be narrower for gas development access roads since they may be closed to the public (Perry and Overly 1976), and are infrequently used (e.g., once per day, or less). Avoidance is reinforced by unpleasant experiences during the hunting seasons (Geist 1970) and by the perceived threat from vehicles and humans outside the hunting seasons. The above zones of disturbance were developed based on displacement from individual roads. Closing gravel roads open to the public through big game winter ranges can reduce adjacent zones of disturbance and increase habitat effectiveness.

A 0.25 mile zone of disturbance buffer was applied to all existing and proposed roads and facilities. Habitat loss within this buffer was adjusted to reflect the various levels of disturbance attributed to vehicle access. Roads and facilities were assigned as a 10 percent, 40 percent, or 70 percent habitat loss and then summarized by acreages for each range type for each alternative (Table J–40).

Table J–39 Mule Deer, Road, and Motorized Trail Densities in the Project Area

Range, Mule Deer Habitat	Surface Ownership				Total
	FS	BLM	State	Private	
Existing Condition					
Winter Concentration Area	0.8	0.5	1.8	2.2	2.1
Severe Winter Range	0.7	0.4	1.8	2.4	2.1
Winter Range	0.3	0.4	1.4	2.2	2.0
Summer Range	1.5	0.4	1.4	2.2	1.8
Alternative 1					
Winter Concentration Area	1.9	0.7	1.8	2.5	2.4
Severe Winter Range	2.3	0.6	1.8	2.7	2.5
Winter Range	2.1	0.7	1.4	2.4	2.4
Summer Range	2.5	0.7	1.4	2.4	2.3
Alternative 1A					
Winter Concentration Area	1.4	0.7	1.8	2.5	2.3
Severe Winter Range	1.7	0.6	1.8	2.7	2.4
Winter Range	1.5	0.7	1.4	2.4	2.3
Summer Range	2.1	0.7	1.4	2.4	2.2
Alternative 1B					
Winter Concentration Area	1.9	0.7	1.8	2.5	2.4
Severe Winter Range	1.8	0.6	1.8	2.7	2.4
Winter Range	1.6	0.7	1.4	2.4	2.3
Summer Range	1.9	0.7	1.4	2.4	2.1
Alternative 2					
Winter Concentration Area	3.8	1.2	1.9	2.6	2.6
Severe Winter Range	3.3	0.9	1.9	2.8	2.7
Winter Range	3.6	1.0	1.7	2.6	2.7
Summer Range	3.2	1.0	1.7	2.7	2.7
Alternative 3					
Winter Concentration Area	1.9	0.7	1.8	2.5	2.4
Severe Winter Range	2.4	0.6	1.8	2.7	2.5
Winter Range	1.8	0.7	1.4	2.4	2.4
Summer Range	2.0	0.7	1.4	2.4	2.1
Alternative 4					
Winter Concentration Area	1.8	0.7	1.8	2.4	2.4
Severe Winter Range	1.8	0.6	1.8	2.7	2.4
Winter Range	1.8	0.7	1.4	2.4	2.3
Summer Range	2.1	0.7	1.4	2.4	2.2
Alternative 5					
Winter Concentration Area	1.3	0.7	1.8	2.5	2.3
Severe Winter Range	1.1	0.6	1.8	2.7	2.3
Winter Range	0.9	0.7	1.4	2.4	2.2
Summer Range	1.6	0.7	1.4	2.4	1.9

Table J–40 Mule Deer Habitat Effectiveness, Acres of Reduced Habitat Effectiveness Due to Roads, Well Pads, and Facilities

Range Type, Mule Deer	NFS Lands (acres)	Loss on NFS Lands (percent)	Non-NFS Lands (acres)	Loss on Non-NFS Lands (percent)	All Ownerships (acres)
Existing Condition					
Winter Concentration Area	291	5.3	15,783	44	16,074
Severe Winter Range	305	3.7	20,873	44	21,178
Winter Range	459	1.8	30,030	40	30,489
Summer Range	9,043	18.3	30,660	40	39,703
Alternative 1					
Winter Concentration Area	277	5.1	22,386	63	22,663
Severe Winter Range	623	7.5	29,330	62	29,953
Winter Range	1,700	6.8	42,891	58	44,591
Summer Range	9,938	20.1	44,161	58	54,099
Alternative 1A					
Winter Concentration Area	325	6.0	22,473	63	22,798
Severe Winter Range	627	7.6	29,440	62	30,066
Winter Range	1,580	6.3	43,029	58	44,610
Summer Range	9,701	19.6	44,299	58	54,001
Alternative 1B					
Winter Concentration Area	363	6.7	22,473	63	22,836
Severe Winter Range	626	7.6	29,440	62	30,065
Winter Range	1,536	6.2	42,980	58	44,516
Summer Range	9,387	19.0	44,124	58	53,511
Alternative 2					
Winter Concentration Area	480	8.8	23,602	66	24,082
Severe Winter Range	811	9.8	30,561	64	31,372
Winter Range	2,298	9.2	46,895	63	49,193
Summer Range	10,370	21.0	48,529	64	58,899
Alternative 3					
Winter Concentration Area	363	6.7	22,473	63	22,836
Severe Winter Range	733	8.9	29,440	62	30,173
Winter Range	1,613	6.5	43,032	58	44,646
Summer Range	9,211	18.7	44,302	58	53,514
Alternative 4					
Winter Concentration Area	361	6.6	22,468	63	22,829
Severe Winter Range	603	7.3	29,435	62	30,038
Winter Range	1,694	6.8	43,118	58	44,811
Summer Range	9,461	19.2	44,479	59	53,940
Alternative 5					
Winter Concentration Area	310	5.7	22,394	63	22,704
Severe Winter Range	455	5.5	29,170	61	29,625
Winter Range	1,041	4.2	42,683	58	43,723
Summer Range	8,840	17.9	43,923	58	52,763

On NFS lands the most notable effects would occur on winter range. Existing roads contribute to an approximate 2-percent loss of habitat effectiveness. The alternatives would increase this loss to 4- to 9-percent. Existing winter range is currently near optimum conditions; the alternative would introduce a loss of some winter range habitat effectiveness during the Project's production phase.

On non-NFS lands, there has been much larger loss of effective mule deer habitat. Private land has contributed most to this loss. Proposed CBM development on non-NFS lands is similar for all alternatives and would further reduce the amount of effective habitat to about 60 percent.

Harassment that results from activity at a well pad is short-term and is not a major concern for wildlife (Wait 2002). However, the potential for hunting pressure and harassment of wildlife to increase is greater as the number of roads and subsequent human activity in an area increases, resulting in long-term impacts. This impact occurs especially where CBM roads are built on public lands because hunters and other recreationists then have improved access (Hayden 2002, Carron 2002). Access on private lands is generally much more limited, and therefore there is generally less hunting pressure and wildlife harassment. Overall, hunting pressure should not increase appreciable because most roads would be closed to ATV's and restricted to foot and horseback. The impact of hunting would be moderate and greatest in Alternative 2 followed in descending order by Alternatives 1, 1A, 1B, 4, 3, and 5 (Table J-48).

The frequency of vehicle collisions with mule deer may increase in the Project Area because of increased vehicle traffic. However, because many of constructed roads would not be designed for high-speed use, the frequency of vehicle collisions with mule deer is not expected to noticeably increase. Table J–41 presents a comparison and ranking of alternatives based on several types of impacts to mule deer. For all impacts considered, Alternative 2 is the most impacting followed in descending order by Alternatives 1, 1A, 1B, 4, 3, and 5 (Table J–41).

Seasonally important habitats would be affected under each of the alternatives. Most of the deer wintering in the Project Area are thought to fawn outside the Project Area. For those animals that remain to give birth, habitat alterations and disturbances would displace some deer from traditional birthing areas. This displacement would be more pronounced during the construction phase than during the production phase because of the higher level of human activities associated with construction.

J.4.2.8.3 Cumulative Effects

The quantitative analysis is restricted to assessing past, current and future oil and gas development impacts to the Project Area and lands within the bounds of the Southern Ute Reservation. There have been and would continue to be habitat lost to residential development but that component of cumulative impact cannot be quantified due to lack of relevant studies.

A significant portion of non-Forest winter range is located on Southern Ute Indian Reservation land (391,000 acres). The importance of SUIT winter range to deer migrating from the Forest depends on winter snowfall.

Table J–41 Comparison of Alternatives by Disturbance Type

Disturbance	Alternative 1	1A	1B	2	3	4	5
Direct habitat loss							
Magnitude and Type of Effects[1]	Minor–	Minor–	Minor–	Minor–	Minor–	Minor–	Minor–
Ranking of Alternatives[2]	6	5	4	7	2	3	1
Habitat fragmentation							
Magnitude and Type of Effects	Minor–	Minor–	Minor–	Minor–	Minor–	Minor–	Minor–
Ranking of Alternatives	6	4	3	7	2	5	1
Avoidance/or displacement (based on road densities and unroaded areas)							
Magnitude and Type of Effects	Mod–	Mod–	Mod–	High–	Mod–	Mod–	Mod–
Ranking of Alternatives	6	4	3	7	2	5	1
Increased vulnerability to vehicle collision	Moderate (-)	Moderate (-)	Moderate (-)	Moderate (-)	Moderate (-)	Moderate (-)	Moderate (-)
	6	3	2	7	4	5	1
Magnitude and Type of Effects	Mod–	Mod–	Mod–	Mod–	Mod–	Mod–	Mod–
Ranking of Alternatives	6	3	2	7	4	5	1
Recreation-Hunting pressure/ poaching							
Magnitude and Type of Effects	Mod–	Mod–	Mod–	Mod–	Mod–	Mod–	Mod–
Ranking of Alternatives	6	3	2	7	4	5	1
Noise							
Magnitude and Type of Effects	Mod–	Mod–	Mod–	Mod–	Mod–	Mod–	Mod–
Ranking of Alternatives	6	5	4	7	2	3	1
Oil spills/ contaminated reserve pits/increased garbage at facilities							
Magnitude and Type of Effects	Mod–	Mod–	Mod–	Mod–	Mod–	Mod–	Mod–
Ranking of Alternatives	6	5	4	7	2	3	1

Notes:
1. None = immeasurable effect or compensating adverse and beneficial effects, Minor = individuals not likely affected, Mod = (moderate) individuals may be affected but populations would not be affected, "–" = negative effect, "+" = positive effect. Thus, Mod– is a moderate negative effect.
2. Rankings are in order from the least impact (1) to the greatest impact (7).

The past, present, and reasonably foreseeable cumulative impacts to deer habitats are given on Table J–42. Existing effects include acres of habitat already impacted by oil and gas development and projected development within the SUIT Reservation. Therefore, cumulative effects for each alternative are the sum of existing effects and the projected effects for each alternative. The estimated loss of habitat effectiveness within the SUIT portion of the cumulative effects area was taken from the SUIT FEIS (BLM et al. 2002).

Other actions that have had the potential to influence both summer and winter range habitat include: timber harvest, livestock grazing, wildfire suppression, prescribed fire, and access management.

Table J–42 Extent and Proportion of Cumulative Impacts to Mule Deer Habitats from Oil and Gas Development — Acres of Reduced Habitat Effectiveness

	Existing Effects	Cumulative Effects by Alternative							Available (acres)
		1	1A	1B	2	3	4	5	
NFS lands									
Winter Conc. Area									
Areal Extent (acres)	284	282	244	282	361	282	294	227	5,453
Portion (percent)[1]	5	5	4	5	7	5	5	4	
Severe Winter Range									
Areal Extent (acres)	317	556	450	446	625	556	423	296	8,272
Portion (percent)	4	6	5	5	8	6	5	4	
Winter Range									
Areal Extent (acres)	465	1,626	1,338	1,316	1,965	1,400	1,442	843	24,948
Portion (percent)	2	7	5	5	8	6	6	3	
Summer Range									
Areal Extent (acres)	465	2,754	2,209	1,965	3,476	1,830	2,145	905	49,383
Portion (percent)	1	6	4	4	7	4	4	2	
Cumulative Effects Analysis Area (NSJB Project Area and SUIT Study Area)									
Winter Conc. Area									
Areal Extent (acres)	24,529	27,565	27,527	27,565	27,643	27,565	27,577	27,510	113,227
Portion (percent)	22	24	24	24	24	24	24	24	
Severe Winter Range									
Areal Extent (acres)	115,443	150,429	150,323	150,322	150,498	150,429	150,296	150,169	221,858
Portion (percent)	52	68	68	68	68	68	68	68	
Winter Range									
Areal Extent (acres)	120,926	220,656	220,368	220,346	220,995	220,430	220,472	219,873	490,366
Portion (percent)	25	45	45	45	45	45	45	45	
Summer Range									
Areal Extent (acres)	211,125	319,414	318,869	318,625	320,136	318,491	318,806	317,565	541,842
Portion (percent)	39	59	59	59	59	59	59	59	

Note:
1. Portion of range or habitat available.

Past logging on NFS land within mule deer habitat has most likely had a minor impact on deer and their habitat. Most of the past timber management has been in the ponderosa pine type where there has been a decrease in canopy closure of mature stands. This has resulted in a slight decrease in cover and increase in forage. Foreseeable timber sales may continue to shift cover to forage. On private land, greater patches of habitat were permanently removed through timber harvest for residential construction, thus impacts are most likely moderate on the western side of the Project Area. Impacts on SUIT land are minor, since there is no major commercial source of timber that has been harvested.

The prescribed fire that has and would take place in the Project Area is viewed as a beneficial force in shaping mule deer habitat because of the disturbance that enhances early successional stages of vegetation.

Within the NFS land of the Project Area, past roading has moderately affected mule deer habitat. Old logging roads have created paths for ATVs for hunting, increasing mortality. Implementing effective road closures and enforcement of

the ATV loops and other mitigation measures would reduce human-wildlife conflict under the proposed project. Therefore, recreational impacts, specifically hunting, are expected to moderately impact the mule deer population. Roads on SUIT land probably have a moderate effect due to high road densities. On the western side of the Project Area, increased roading (such as county roads and U.S. Highway 160), agricultural clearing of native species, and residential development has had a moderate to high impact to the mule deer habitats. Past residential development and road construction in some mule deer habitats has probably caused a greater loss of sagebrush, mountain shrubs, and other mule deer habitats than has oil and gas development to date.

Anticipated residential development suggests that additional sagebrush and mountain shrub habitats will be lost in the future, further reducing the availability of mule deer habitats. The increase in residential developments within deer habitats can also increase harassment by domestic animals. Deer and human encounters in the form of vehicle collisions are also increasing within incorporated areas of the cumulative effects analysis area.

Predation, particularly by coyotes, has been proposed as a primary factor in the decline of mule deer throughout the West. The only certainty is that predators kill and eat mule deer. However, studies that investigated responses of entire mule deer herds to intensive coyote control have failed to demonstrate that mule deer numbers increased as a result of coyote control (Gill 2001).

J.4.2.8.4 Relationship of Project Effects to Forest-wide Population and Habitat Trends

This section tiers to Forest-wide MIS Assessment, and evaluates how implementation of the proposed project would contribute to mule deer population and habitat trends across the entire SJNF. Mule deer populations have fluctuated over the past twenty years primarily in response to climatic conditions and effects of hunting. In general, deer numbers have been declining at least since the late 1950s and 1960s. However, CDOW terrestrial biologist Scott Wait (2002), reports a slight upward population trend for mule deer in the last decade. Current herd populations are relatively stable using post-harvest population estimates. In 2001, CDOW estimated a combined DAU population for southwest Colorado of 68,663 mule deer. Four mule deer DAUs encompass the SJNF and all four have areas that extend well beyond the Forest boundary.

Within the Project Area, there are currently sufficient habitats available to support a population of resident mule deer, and winter range for up to 63 percent of the DAU D–30 population (about 12,200 deer) on NFS lands. The alternatives would moderately affect habitat, but would not affect hunting and hunter success. Therefore the alternatives would not produce a population-limiting factor that would contribute to a change in population. Deer population would continue to be influenced primarily by winter severity and hunter success. The project would not compromise mule deer population or long-term population trend across the SJNF.

In terms of habitat impacts, the SJNF would continue to provide habitat to support current populations of mule deer and the habitat would be well distributed so that individuals can interact with others in the planning area. The project would

not contribute to a measurable change in habitat quality and distribution across the SJNF

J.5 Forest Plan Conformance

The Forest Plan direction for wildlife consists of Forest Direction and Management Area Direction (FS 1992). The Forest Direction details overall management requirements that are to be achieved or maintained across the SJNF over time. Management Area Direction presents more specific direction for areas of land on the SJNF called management areas. Management areas are zones within a larger landscape.

The following Forest Plan (FS 1992) direction and guidelines apply to NFS land within the Project Area.

J.5.1 Forest Direction

Maintain habitat for viable populations of all existing vertebrate wildlife species (FS 1992:III–26). The management guideline for this direction is to maintain habitat for each vertebrate species on the SJNF at least at 40 percent or more of potential.

J.5.2 Management Area Direction

Management direction for five management areas: 2B, 3A, 4B, 5B, and 6B apply to the Project Area. For vertebrate species, the 40-percent habitat potential guideline applies to management areas 2B, 3A and 5B (35,000 acres), a 60-percent habitat potential guideline applies to management area 6B (6,000 acres) and an 80-percent guideline applies to management area 4B (12,000 acres). Additionally an 80-percent guideline applies to deer and elk habitat in management area 5B.

The 4B management area is within the HD Mountains Roadless area and has no prior history of timber management, or roading and has received light grazing over the past few decades. The 6B management area is in the Sauls Creek area and has a history of timber harvest and tree thinning that dates back to the 1940s. The 6B area emphasizes range management, the tree stands are mostly even-aged ponderosa pine, 12-inch average DBH with a fairly closed canopy, very well interspersed with meadows. The 6B area has also experienced CBM development beginning in the early 1990s. To determine whether the SJNF portion of the Project Area is currently meeting these standards, we reconstructed actions and trends that may have impacted wildlife habitat potential.

The NFS portion of the project area has experienced changes in vegetative cover type and composition as a result of timber harvest, fire suppression, and grazing. Timber harvest has converted approximately 6,000 acres of old, large mature pine to younger, more uniform stands of saw timber sized stands in the Sauls Creek area and along the east flank of Pargin Mountain. Recorded timber harvest began on the 1940s. In addition, we suspect that there was much earlier harvest

along the flanks of the HD's due to settlement in and around La Plata County that removed the large tree component of many stands.

Fire suppression and grazing have contributed to the following trends: There is less grassland today than in the past due to slow encroachment of pinyon-juniper into grassland ecosystems. Similarly, there is less sagebrush meadow due to pinyon-juniper encroachment. The ongoing Forest Service use of prescribed fire in these cover types has slowed this encroachment, however. Some ponderosa pine stands along the ecotone with mixed conifer have experienced slow encroachment of mixed conifer, which could also be reversed through prescribed fire management. Mixed conifer stands have become denser, and more dominated by white fir than in the past. Finally, aspen, gambel oak and spruce-fir stands have continued to mature. The continued maturation of aspen could result in partial loss of its representation where stands are not self-regenerating.

In addition, portions of the HD Mountains have been roaded over time. Currently, about 28,000 acres of the 49,500-acre area remains unroaded. Many of the roads are closed to motorized vehicles providing for habitat security, but there is moderate use of the Saul's Creek road system during all seasons and moderate use of the entire area's roads by ATVs during hunting season. During winter roads are closed and snowed out. Many roads are also gated during the summer to restrict public use.

With these habitat changes and the limited wildlife-human interaction, the HD Mountains Area continues to provide habitat for vertebrate species at least at 40-percent of potential. The 12,000 acre 4B management area most likely also provides habitat at 80-percent of potential because it continues to remain unroaded, unlogged, lightly grazed, and isolated from recreational activities. The 6,000-acre 6B management area, located generally around Sauls Creek presents somewhat more of a complicated set of circumstances due to past harvest, roading and recreational use. The concerns of the biologist team on the San Juan NF is that the area may not be meeting the 60-percent habitat potential guideline for, hairy woodpecker, and bluebird and the other species they represent as MIS. There is also concern that a lack of snags in Sauls Creek may adversely affect hairy woodpecker and bluebird habitat. Further field investigation will be conducted to determine whether the 6B area is currently meeting the 60-percent habitat potential guideline.

Each of the alternatives would affect habitat capability in different ways and in different areas. Alternative 2 would have the greatest impact, followed in descending order by Alternatives 1, 1A, 4, 3, 1B, and 5. The largest impact would be in the ponderosa pine habitat, resulting in an approximately 5-percent physical reduction in pine habitat in Alternative 2 and lesser impacts in the other alternatives. The physical habitat alteration and loss of habitat would not in itself result in a measurable change in habitat capability when compared to the current situation. In addition, the 4B management area would remain unroaded and undeveloped under Alternatives 1, 1A, 1B 3, and 5, maintaining that area at least at 80-percent of habitat capability. Alternatives 2 and 4 would develop much of the 4B area and there would be a slight loss of habitat capability.

A change in road management would be implemented in Alternatives 1 through 3 to restrict on and off road motorized travel to a few designated routes. All other routes would be closed to public use (see Recreation section of this chapter). This mitigation is designed to significantly reduce human-wildlife conflict and resultant loss in wildlife habitat capability. However, non-CBM related foot and horseback traffic during hunting season would seasonally reduce habitat capability across the entire HD Mountains area. With the change in road management, the same habitat conclusions would apply: The HD Mountains would continue to provide for 40 percent habitat capability under all alternatives. The 4B management area would continue to provide for 80-percent habitat capability in Alternatives 1, 1A, 1B, 3 and 5, but would experience reduced capability in Alternatives 2 and 4. The 6B management area would continue to provide for 60-percent of habitat capability for all alternatives, for all species, with the possible exception of hairy woodpecker, bluebird, and the species they represent. The 60-percent habitat capability standard can be maintained or promoted for these species through management that includes tree thinning and prescribed fire in the grassland, sagebrush and pine types and prohibitions on standing dead tree harvest. These activities would be accomplished through wildlife habitat improvement projects.

The other applicable Forest Plan guidelines include:

Maintain one Abert's squirrel nest-tree clump (0.1 acre of 9-inches-to-22-inches-d.b.h. ponderosa pine with a basal area of 180 to 220 and an interlocking canopy) per two acres on all ponderosa pine sale areas (FS 1992:III–147). No systematic inventory data exist that show whether the SJNF is meeting this guideline. However, based on knowledge of pine forest characteristics in the Project Area, it is likely that the SJNF is meeting this guideline. The SJNF would continue to meet the guideline under all alternatives because only a small proportion of ponderosa pine habitats (0.5 to 5- percent) would be affected under each alternative.

For woodpecker and bluebird and the wildlife species they represent, protect and provide 25 snags/10 acres in forested types, also provide for snag replacement. Through on-site observations, we believe that the snag guideline is not being met in portions of the pine type, particularly in Sauls Creek. Further field investigation will be conducted to ascertain snag density. The alternatives would not contribute measurably to additional snag loss.

For big game, specifically deer and elk, provide for 80-percent habitat capability within 5B management areas. The 5B management areas specifically emphasize management for big game winter range. The guideline would be met in the 5B area under all the alternatives. The control of vehicular access during the winter months is prescribed to specifically maintain winter habitat capability for deer, elk, and other wildlife species in general.

Other forest plan guidelines apply to wildlife habitat structural improvements and/or habitat guidelines that would be maintained or accomplished through timber sales, and do not apply to this project.

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Appendix K

Bureau of Land Management Sensitive Species Analyses

APPENDIX K

BUREAU OF LAND MANAGEMENT SENSITIVE SPECIES ANALYSES

NORTHERN SAN JUAN BASIN COAL BED METHANE DEVELOPMENT ENVIRONMENTAL IMPACT STATEMENT

San Juan National Forest
San Juan Field Office, Bureau of Land Management

Archuleta and La Plata Counties

Prepared by:

The San Juan Public Lands Center

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Appendix K — Bureau of Land Management Sensitive Species

K.1 Summary of Evaluation

Twenty-seven BLM sensitive species were initially considered in this evaluation. After examining occurrence information and availability of suitable habitat, 13 of these species were not expected to inhabit the Project Area and therefore removed from further consideration. Seven of these species were evaluated as Forest Service sensitive or Management Indicator Species (MIS). The complete examination of these species can be found in the Biological Evaluation or the MIS Analysis. For each of the 14 BLM sensitive species that may occur in the Project Area, potential impacts from the alternatives did not exceed one percent of the suitable habitat available under BLM administration.

Table K–1 presents the complete list of BLM species considered and the amount of suitable habitats available to those species that may occur on BLM lands in the Project Area. Table K–2 presents amount of suitable habitats for each species on BLM lands in the Project Area that would be affected by each alternative. Table K–3 presents the amount of suitable habitats for each species that would be affected by each alternative in the cumulative effects analysis area.

For each of the remaining 7 species, a complete evaluation was presented including descriptions of protective status, distribution, life history, factors of concern, environmental baseline, effects, and mitigation recommendations, when appropriate.

Table K–1 Species Considered and Habitat Availability

Species	Evaluated in Detail?	Acres of Suitable Habitat on BLM Land within the Project Area	Percentage of BLM Land within Project Area that is Suitable Habitat
Cronquist milk-vetch	No	N/A	N/A
Naturita milk-vetch	No	N/A	N/A
Kachina daisy	No	N/A	N/A
Comb Wash buckwheat	No	N/A	N/A
Gunnison sage grouse	No	N/A	N/A
Ferruginous hawk	No	N/A	N/A
Black tern	No	N/A	N/A
Western yellow-billed cuckoo	No	N/A	N/A
White-faced ibis	No	N/A	N/A
Columbian sharp-tailed grouse	No	N/A	N/A
Texas horned lizard	No	N/A	N/A
Desert spiny lizard	No	N/A	N/A
Colorado River cutthroat trout	No	N/A	N/A
Pagosa skyrocket	Yes	4,630	69%
Pagosa Springs bladderpod	Yes	5,203	78%
Townsend's big-eared bat	Yes	5,454	82%
Spotted bat	Yes	5,454	82%
Allen's (Mexican) big-eared bat	Yes	5,658	85%
Fringed myotis	Yes	3,540	53%
Yuma myotis	Yes	7	<1%
Big free-tailed bat	Yes	369	6%
Northern goshawk	Yes	848	13%
Bluehead sucker	Yes	0	0%
Flannelmouth sucker	Yes	0	0%
Roundtail chub	Yes	0	0%
Milk snake	Yes	6,643	99%
Northern leopard frog	Yes	7	<1%

Table K–2 Suitable Habitat Affected by each Alternative on BLM Lands

	Alternative 1		Alternative 1A		Alternative 1B		Alternative 2		Alternative 3		Alternative 4		Alternative 5	
Species	Acres of Suitable Habitat Affected	Percent of Suitable Habitat Affected	Acres of Suitable Habitat Affected	Percent of Suitable Habitat Affected	Acres of Suitable Habitat Affected	Percent of Suitable Habitat Affected	Acres of Suitable Habitat Affected	Percent of Suitable Habitat Affected	Acres of Suitable Habitat Affected	Percent of Suitable Habitat Affected	Acres of Suitable Habitat Affected	Percent of Suitable Habitat Affected	Acres of Suitable Habitat Affected	Percent of Suitable Habitat Affected
Pagosa skyrocket[1]	22	<1%	22	<1%	22	<1%	43	<1%	22	<1%	22	<1%	18	<1%
Pagosa Springs bladderpod[1]	27	<1%	22	<1%	22	<1%	49	<1%	28	<1%	28	<1%	24	<1%
Townsend's big-eared bat[1]	28	<1%	29	<1%	29	<1%	50	<1%	28	<1%	28	<1%	24	<1%
Spotted bat[1]	28	<1%	29	<1%	29	<1%	50	<1%	28	<1%	28	<1%	24	<1%
Allen's (Mexican) big-eared bat	25	<1%	25	<1%	25	<1%	49	<1%	25	<1%	25	<1%	21	<1%
Fringed myotis	18	<1%	18	<1%	18	<1%	33	<1%	15	<1%	15	<1%	12	<1%
Yuma myotis	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%
Big free-tailed bat	0	0%	0	0%	0	0%	6	2%	0	0%	0	0%	0	0%
Northern goshawk[2]	4	<1%	2	<1%	2	<1%	10	1%	7	<1%	7	<1%	6	<1%
Bluehead sucker	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%
Flannelmouth sucker	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%
Roundtail chub	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%
Milk snake[1]	30	<1%	31	<1%	31	<1%	55	<1%	31	<1%	31	<1%	27	<1%
Northern leopard frog[1]	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%

Notes:
1. Analyzed in the Biological Evaluation.
2. Analyzed in the MIS Analysis.

Table K–3 Suitable Habitat Affected by each Alternative in the Cumulative Effects Analysis Area

	Alternative 1		Alternative 1A		Alternative 1B		Alternative 2		Alternative 3		Alternative 4		Alternative 5	
Species	Acres of Suitable Habitat Affected	Percent of Suitable Habitat Affected	Acres of Suitable Habitat Affected	Percent of Suitable Habitat Affected	Acres of Suitable Habitat Affected	Percent of Suitable Habitat Affected	Acres of Suitable Habitat Affected	Percent of Suitable Habitat Affected	Acres of Suitable Habitat Affected	Percent of Suitable Habitat Affected	Acres of Suitable Habitat Affected	Percent of Suitable Habitat Affected	Acres of Suitable Habitat Affected	Percent of Suitable Habitat Affected
Pagosa skyrocket[1]	2,096	<1%	11,745	4.5%	11,562	4.4%	2,145	<1%	2,088	4.7%	2,101	<1%	2,069	<1%
Pagosa Springs bladderpod[1]	16,874	5.6%	17,470	5.8%	17,243	5.7%	17,516	5.8%	16,562	4.4%	16,590	5.5%	16,254	5.4%
Townsend's big-eared bat[1]	22,043	5.3%	23,353	5.6%	23,223	5.6%	22,520	5.4%	21,905	5.3%	21,933	5.3%	21,744	5.2%
Spotted bat[1]	22,043	5.3%	23,353	5.6%	23,223	5.6%	22,520	5.5%	21,905	5.3%	21,933	5.3%	21,744	5.2%
Allen's (Mexican) big-eared bat	18,006	4.8%	18,633	5.0%	18,411	4.9%	18,625	5.0%	17,702	4.7%	17,726	4.7%	17,416	4.6%
Fringed myotis	10,431	4.5%	10,788	4.6%	10,630	4.6%	10,806	4.6%	10,210	4.4%	10,220	4.4%	9,978	4.3%
Yuma myotis	495	5.6%	506	5.7%	506	5.7%	495	5.6%	495	5.6%	495	5.6%	495	5.6%
Big free-tailed bat	89	3.8%	128	5.5%	129	5.5%	98	4.2%	86	3.7%	87	3.8%	83	3.6%
Northern goshawk[2]	1,572	5.9%	902	3.4%	806	3%	1,813	6.8%	1,387	2.4%	1,372	5.1%	1,220	4.6%
Bluehead sucker	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Flannelmouth sucker	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Roundtail chub	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Milk snake[1]	23,115	5.1%	23,865	5.2%	23,669	5.2%	23,791	5.2%	22,846	5.0%	22,840	5.0%	22,534	4.9%
Northern leopard frog[1]	496	5.5%	507	5.6%	27	5.6%	496	5.5%	496	5.5%	496	5.5%	496	5.5%

Notes:
1. Analyzed in the Biological Evaluation.
2. Analyzed in the MIS Analysis.

K.2 Species Considered but Eliminated from Detailed Evaluation

All BLM sensitive species known to occur within the area administered by the San Juan Field Office were evaluated for their potential to occur in the Project Area. Based on this evaluation, it was determined that a number of these species are not expected to occur because the Project Area is either outside of their range or does not contain potential habitat for the species. This group of species would not be impacted by the proposed project and have been eliminated from further detailed evaluation. The rationale for this elimination is discussed for each species below.

K.2.1 Cronquist Milk-vetch

This species is known to occur only in Montezuma County in Colorado, over 40 miles southwest of the Project Area. There are no known occurrences of this species in the Project Area. This species is not expected to occur because of the distance between known occurrences and the Project Area.

K.2.2 Naturita Milk-vetch

This species is known to occur in Garfield, Mesa, Montrose, San Miguel, and Montezuma counties in Colorado. There are no known occurrences of this species in the Project Area. The closest known location in Montezuma County is approximately 40 miles southwest of the Project Area. This species is not expected to occur based on the distance between known occurrences and the Project Area.

K.2.3 Kachina Daisy

This species is known to occur only in Montrose County in Colorado, over 80 miles north of the Project Area. There are no known occurrences of this species in the Project Area. This species is not expected to occur based on the distance between known occurrences and the Project Area.

K.2.4 Comb Wash Buckwheat

This species is known to occur only in Montezuma County, over 40 miles southwest of the Project Area. There are no known occurrences of this species in the Project Area. This species is not expected to occur based on the distance between known occurrences and the Project Area.

K.2.5 Gunnison Sage Grouse

Historically, Gunnison sage grouse occurred in southwestern Colorado and southeastern Utah. The Project Area is within the historic range of this species. The Gunnison sage grouse has since been extirpated from much of its historic

range, occurring now in only eight disjunct populations with a total effective breeding population of approximately 4,000 birds (Young 1998). The largest known population is in the Gunnison Basin of Colorado. The closest extant population is found on the Colorado-Utah border in Dolores and San Miguel counties, approximately 50 miles northwest of the Project Area. Use of the Project Area by this species is not anticipated based on the distance from known populations and the degradation and loss of much of the suitable breeding habitat that once occurred in the area.

K.2.6 Ferruginous Hawk

This species has been eliminated from detailed discussion. The rationale for dismissal is discussed in the Biological Evaluation (Appendix I).

K.2.7 Black Tern

This species has been eliminated from detailed discussion. The rationale for dismissal is discussed in the Biological Evaluation (Appendix I).

K.2.8 Western Yellow-billed Cuckoo

This species has been eliminated from detailed discussion. The rationale for dismissal is discussed in the Biological Evaluation (Appendix I).

K.2.9 White-faced Ibis

This species has been eliminated from detailed discussion. The rationale for dismissal is discussed in the Biological Evaluation (Appendix I).

K.2.10 Columbian Sharp-tailed Grouse

This has been eliminated from detailed discussion. The rationale for dismissal is discussed in the Biological Evaluation (Appendix I).

K.2.11 Texas Horned Lizard

This species has been eliminated from detailed discussion. The rationale for dismissal is discussed in the Biological Evaluation (Appendix I).

K.2.12 Desert Spiny Lizard

The desert spiny lizard occurs throughout the southwestern United States and northern Mexico, including the southern part of the Great Basin and Colorado Plateau. This species is known to occur in extreme southwestern Colorado in Montezuma County, at elevations below approximately 5,100 feet (Hammerson 1999). It is not expected to occur in the Project Area.

K.2.13 Colorado River Cutthroat Trout

This species been eliminated from detailed discussion. The rationale for dismissal is discussed in the Biological Evaluation (Appendix I).

K.3 Species Evaluated in Detail

The remaining BLM sensitive species may occur in the Project Area based on known occurrences of, or the presence of suitable habitats for, these species. Detailed evaluations of the potential impacts of the proposed project on these species have been conducted and are discussed in the following sections. For each species, general information about the species, including its status, distribution, life history, and factors of concern are reviewed. The environmental baseline includes a summary of past and present impacts of federal, state, and private actions and other human activities in the Project Area (including past and on-going CBM development) on each species. Direct, indirect, and cumulative effects of the proposed project on each species are discussed. Finally, additional mitigation measures beyond those that are integral to the proposed action are recommended.

The BLM administers over 6,600 acres of land within the Project Area. More than 1,800 acres within pinyon-juniper, 1,700 acres in ponderosa pine, and 1,100 acres in sagebrush. Other vegetation types under BLM administration within the Project Area include grassland, mountain shrub, Gambel oak, mixed conifer, aspen, riparian, and barren. Table K–4 summarizes the general habitat associations for each of the BLM sensitive species evaluated in this report. Table K–5 presents the amount of each habitat structural stage for each vegetation type that is present on BLM lands in the Project Area.

K.3.1 Pagosa Skyrocket

The Pagosa skyrocket is discussed in detail in the Biological Evaluation (Appendix I).

K.3.2 Pagosa Springs Bladderpod

The Pagosa Springs bladderpod is discussed in detail in the Biological Evaluation (Appendix I).

K.3.3 Townsend's Big-eared Bat

The Townsend's big-eared bat is discussed in detail in the Biological Evaluation (Appendix I).

K.3.4 Spotted Bat

The spotted bat is discussed in detail in the Biological Evaluation (Appendix I).

Table K–4 BLM Sensitive Species Habitat Associations

Species	Habitat											
	Grassland	Sagebrush	Pinyon-Juniper	Mountain Shrub	Gambel Oak	Ponderosa Pine	Mixed Conifer	Aspen	Riparian/Wetland	Barren	Water	
Pagosa skyrocket[1]			X		X	X				X		
Pagosa Springs bladderpod[1]	X		X		X	X	X			X		
Townsend's big-eared bat[1]	X	X	X	X	X	X[2]	X[2]	X[2]	X			
Spotted bat[1]	X	X	X	X	X	X[2]	X[2]	X[2]	X			
Allen's (Mexican) big-eared bat		X	X	X	X	X	X		X			
Fringed myotis			X			X	X					
Yuma myotis									X			
Big free-tailed bat										X		
Northern goshawk[1]						X[3]	X[3]	X[3]				
Bluehead sucker											X	
Flannelmouth sucker											X	
Roundtail chub											X	
Milk snake[1]		X	X	X	X	X	X			X		
Northern leopard frog[1]									X		X	

Notes:
1. Analyzed in the Biological Evaluation.
2. Excluding habitat structural stages 3B, 3C, 4B, 4C, and 5.
3. Including only habitat structural stages 4B, 4C, and 5.

Table K–5 Habitat Structural Stages on BLM Lands in the Project Area

Vegetation Type	Structural Habitat Stage												
	n/a	1M	1T	2S	2T	3A	3B	3C	4A	4B	4C	5	Total
Grasslands	0	459	181	0	0	0	0	0	0	0	0	0	640
Sagebrush	0	0	0	1,168	0	0	0	0	0	0	0	0	1,168
Pinyon-Juniper	0	0	0	0	0	409	848	0	329	236	0	0	1,822
Mountain Shrub	0	0	0	289	0	0	0	0	0	0	0	0	289
Gambel Oak	0	0	0	636	17	0	0	0	0	0	0	0	653
Ponderosa Pine	0	0	0	0	0	22	47	3	827	731	5	65	1,700
Mixed Conifer	0	0	0	0	0	0	3	0	1	10	2	0	18
Aspen	0	0	0	0	0	1	1	0	0	1	0	0	4
Riparian	0	0	0	1	0	0	0	0	6	0	0	0	7
Agriculture	0	0	0	0	0	0	0	0	0	0	0	0	0
Barren	369	0	0	0	0	0	0	0	0	0	0	0	369
Water	0	0	0	0	0	0	0	0	0	0	0	0	0
Total	369	462	178	2,094	17	433	900	4	1,186	1,021	7	65	6,671

K.3.5 Allen's (Mexican) Big-eared Bat

K.3.5.1 Species Information

K.3.5.1.1 Status

The Allen's (Mexican) big-eared bat is classified as a sensitive species by the BLM in the State of Colorado. This species can be locally common, but is rare through much of its range and is of special concern because of low population sizes.

K.3.5.1.2 Distribution

This species occurs throughout the southwestern United States and into Mexico. Allen's big-eared bat has not been documented in Colorado, but is expected to occur in the southwestern corner of the state and has been recorded nearby in southeastern Utah. It may occur in suitable habitats in the Project Area (Fitzgerald et al. 1994). Within the Project Area, there are 5,657 acres of sagebrush, pinyon-juniper, mountain shrub, Gambel oak, ponderosa pine, mixed conifer, and riparian/wetland community types on BLM lands that may be suitable for the Allen's (Mexican) big-eared bat (Table K–5).

K.3.5.1.3 Life History

This species can be relatively common in canyons forested with oak, pine, and other conifer species, but is rare over most of its range. It has also been documented in pinyon-juniper, shrublands, and riparian woodlands. It appears to be associated with habitats with cliffs, outcroppings, boulder piles, or lava flows nearby (Harvey et al. 1999). Caves, mines, rock shelters, and other similar types of shelter are preferred for day roosts. Roosts may be shared with other species including the fringed myotis and Townsend's big-eared bat (Fitzgerald et al. 1994). Prey species include moths and beetles gleaned from vegetation or the ground. Seasonal movements and wintering locations are unknown.

K.3.5.1.4 Factors of Concern

Disturbance of roost sites is of primary concern for this species. Its low density of occurrence makes protection of existing roost sites extremely important to conservation of this species.

K.3.5.2 Environmental Baseline

No CBM-related impacts to Allen's (Mexican) big-eared bat have been documented. Other activities that have occurred in the Project Area, such as agriculture, residential and commercial development, and road construction, may have impacted this species; however, the extent of these impacts and their effects on the Allen's (Mexican) big-eared bat are not known because of a lack of data on the historic and current populations of this species in the Project Area.

K.3.5.3 Effects of the Proposed Project

The types of effects to this species are the same among the different alternatives and only vary according to the amount of disturbed habitats estimated for each alternative. Table K–2 summarizes the amount of disturbance by alternative to

Allen's big-eared bat habitats on BLM lands. Alternative 2 would disturb 49 acres (<1 percent) of the habitats on BLM lands within the Project Area, the most disturbance by any alternative. Alternatives 1, 1A, 1B, 3, and 4 would each disturb 25 acres (<1 percent) and Alternative 5 would disturb 21 acres (<1 percent) of the habitats on BLM lands within the Project Area.

Potential impacts to the Allen's big-eared bat caused by implementation of any of the alternatives include injury or mortality of individuals, disturbance, or displacement of individuals from roosts, and degradation or destruction of suitable foraging habitats. Injury or mortality of the Allen's big-eared bat may occur from construction activities within foraging habitats. Although the potential for injury or mortality exists, it is expected to be low because project activities are not expected to occur during twilight hours when this species typically forages.

Construction activities and increased human presence within the Project Area may limit the use of roosting sites, including caves, mines, rock crevices, and hollow trees. Disturbance is not expected to occur to some roosting habitats including caves, mines, and rock outcrops. This species forages in a variety of habitats, all of which are likely to experience some degree of disturbance. Although the carrying capacity of undisturbed foraging habitats and the suitability of these habitats to support displaced bats are unknown, bats are expected to utilize these habitats without impacts to individual health or population status. Project activities are not expected to impact the local occurrence or availability of this bat's preferred invertebrate prey species.

Within the cumulative effects analysis area, there are 376,231 acres of suitable sagebrush, pinyon-juniper, mountain shrub, Gambel oak, ponderosa pine, mixed conifer, and riparian/wetland habitats for the Allen's big-eared bat. Depending on alternative, between 18,163 and 19,368 acres of these habitats would be cumulatively disturbed by past oil and gas activities, the project alternatives and the selected alternative for the SUIT EIS. The cumulative disturbance to these habitats accounts for 4.8 to 5.1 percent of the available habitats in the cumulative effects analysis area. The Allen's big-eared bat uses relatively small-scale unique habitat features as roost sites within the more general habitat categories for which acreage estimates are available. These estimates of general cumulative habitat loss represent an attempt to quantify impacts to Allen's big-eared bat foraging habitats in the cumulative effects analysis area. While it is unlikely that most of these habitats support the Allen's big-eared bat, this analysis gives a relative indication of the extent of potential cumulative effects to this species. Activities on private lands, such as sand and gravel mining, livestock grazing, agriculture, road construction, and rural and urban housing development would occur in habitats that may support the spotted bat. However, the extent of these impacts and the potential for them to affect this species are not quantifiable.

Other cumulative effects to the Allen's big-eared bat, such as reduced habitat effectiveness, vehicle collision, individual mortality, and habitat fragmentation, would occur but are not quantifiable. The level of these effects on public and tribal lands is primarily related to oil and gas development and road use, while on private lands, residential development is also a major factor. For this reason, a trend similar to those examined for habitat is expected for these effects. Mitigation measures designed to avoid effects to the Allen's big-eared bat from all pro-

ject activities would be implemented and would minimize the potential for any cumulative effects to this species.

K.3.5.4 Additional Recommendations or Mitigation Measures

If potential roosting habitat were identified within the Project Area, pre-construction surveys would be conducted to determine roost occupancy. Additional mitigation measures would be developed based upon the results of these surveys.

K.3.6 Fringed Myotis

K.3.6.1 Species Information

K.3.6.1.1 Status

The fringed myotis is classified as a sensitive species by the BLM in the State of Colorado. It has been considered rare in Colorado and is of special concern, but with a greater understanding of habitats and habits, this species is apparently more widespread than previously thought (Armstrong et al. 1994).

K.3.6.1.2 Distribution

The fringed myotis is found south to Mexico, northward to south-central British Columbia and from the Pacific coast eastward to the Black Hills of South Dakota and Wyoming. In Colorado it is found on both sides of the Continental Divide at moderate elevations, but not in the higher mountains. Occurrence of this species has been documented in Montezuma and La Plata counties. There are no records of occurrence within the Project Area although it may occur in suitable habitats. There have been no surveys conducted for this species in the Project Area to date. Within the Project Area, there are 3,540 acres of pinyon-juniper, ponderosa pine, and mixed conifer community types on BLM lands that may be suitable for the fringed myotis (Table K–5).

K.3.6.1.3 Life History

This species inhabits coniferous woodlands at moderate elevations (5,000 to 8,000 feet) in mountainous regions of the state. Caves, mines, and abandoned buildings serve as day and night roosts (Armstrong et al. 1994). Tree-roosting has also been documented in large conifer snags in Oregon, in ponderosa snags in New Mexico, and in hollow redwood and giant sequoia trees in California. Hibernacula in Colorado have not been identified but they use caves and buildings in other parts of their range. The fringed myotis is a colonial species, forming colonies ranging in size up to hundreds of individuals (O'Farrell and Studier 1980). Breeding begins in the fall with the sperm stored over winter and fertilization occurring in the spring. Young are born in early- to mid-summer.

Limited information is available on diet of the fringed myotis. Known prey species include beetles, moths, crickets, crane flies, and spiders. The presence of non-flying prey species in the diet of the Oregon animals suggests a foraging

style that relies at least partially on gleaning. Foraging activities are concentrated from sunset to midnight (O'Farrell and Studier 1980).

K.3.6.1.4 Factors of Concern

Abandoned mine closures, recreational caving and mine exploration, renewed mining at historic sites, and building and bridge conversion pose threats to roosts. Toxic material impoundments and pesticide spraying can have direct poisoning effects on populations. Vegetation conversion, livestock grazing, and timber harvest can modify the insect prey base and affect populations.

K.3.6.2 Environmental Baseline

No CBM-related impacts to the fringed myotis have been documented. Other activities that have occurred in the Project Area, such as agriculture, residential and commercial development, and road construction, may have impacted this species; however, the extent of these impacts and their effects on the fringed myotis are not known because of a lack of data on the historic and current populations of this species in the Project Area.

K.3.6.3 Effects of the Proposed Project

The types of effects to this species are the same among the different alternatives and only vary according to the amount of disturbed habitats estimated for each alternative. Table K–2 summarizes the amount of disturbance by alternative to fringed myotis habitats on BLM lands. Alternative 2 would disturb 33 acres (<1 percent) of the habitats on BLM lands within the Project Area, the most disturbance by any alternative. Alternatives 1, 1A, and 1B would disturb 18 acres (<1 percent), Alternatives 3 and 4 would each disturb 15 acres (<1 percent) and Alternative 5 would disturb 12 acres (<1 percent) of the habitats on BLM lands within the Project Area.

Potential impacts to the fringed myotis caused by implementation of any of the alternatives include injury or mortality of individuals, disturbance, or displacement of individuals from roosts, and degradation or destruction of suitable foraging habitats. Injury or mortality of the fringed myotis may occur from construction activities within foraging habitats. Although the potential for injury or mortality exists, it is expected to be low because project activities are not likely to occur during twilight hours, when this species typically forages. Construction activities and increased human presence within the Project Area may limit the use of suitable roosting sites, including caves, mines, and trees. Direct disturbance is not expected to occur to some roosting habitats including, caves, mines, and rock outcrops. Cutting of live trees and snags may remove roost sites and cause mortality of individuals if the roosts are occupied. The potential for this impact is low because of the small amount of forested vegetation that would be affected under each alternative. This species forages in a variety of habitats, all of which are likely to experience some degree of disturbance. Although the carrying capacity of undisturbed foraging habitats and the suitability of these habitats to support displaced bats are unknown, bats are expected to use these habitats without impacts to individual health or population status. Project activities are not expected to impact the local occurrence or availability of this bat's preferred invertebrate prey species.

Within the cumulative effects analysis area, there are 233,160 acres of suitable pinyon-juniper, ponderosa pine, and mixed conifer habitats for the fringed myotis. Depending on alternative, between 10,428 and 11,261 acres of these habitats would be cumulatively disturbed by past oil and gas activities, the alternatives to the proposed project, and the selected alternative for the SUIT EIS. The disturbance to these habitats accounts for 4.5 to 4.8 percent of the available habitats in the cumulative effects analysis area for this species. The fringed myotis uses relatively small-scale, unique habitat features as roost sites within the more general habitat categories for which acreage estimates are available. These estimates of cumulative habitat loss represent an attempt to quantify impacts to fringed myotis foraging habitats in the cumulative effects analysis area. While it is unlikely that most of these habitats support the fringed myotis, this analysis gives some indication of the extent of potential cumulative effects to this species. Activities on private lands, such as sand and gravel mining, livestock grazing, agriculture, road construction, and rural and urban housing development would occur in habitats that may support the fringed myotis. The extent of these impacts, and the potential for them to affect this species, are not quantifiable.

Other cumulative effects to the fringed myotis, such as reduced habitat effectiveness, vehicle collision, individual mortality, and habitat fragmentation, would occur but are not quantifiable. The level of these effects on public and tribal lands is primarily related to oil and gas development and road use, while on private lands, residential development is also a major factor. For this reason, a trend similar to those examined for habitat is expected for these effects. Mitigation measures designed to avoid effects to the fringed myotis bat from all project activities would be implemented and would minimize the potential for any cumulative effects to this species.

K.3.6.4 Additional Recommendations or Mitigation Measures

If potentially suitable roosting habitat is identified within the Project Area, preconstruction surveys would be conducted to determine roost occupancy. Additional mitigation measures would be developed based upon the results of these surveys.

K.3.7 Yuma Myotis

K.3.7.1 Species Information

K.3.7.1.1 Status

The Yuma myotis is classified as a sensitive species by the BLM in the State of Colorado and is of special concern because of its patchy distribution and sensitivity to disturbance at roost sites.

K.3.7.1.2 Distribution

The Yuma myotis occurs at lower and middle elevations along the West Coast, the interior of the Pacific Northwest, much of Mexico, and the southwestern United States. It is locally abundant, but is also absent from many areas that ap-

pear to be otherwise suitable (Harvey et al. 1999). In Colorado, this species is common in the canyon and mesa country of the Western Slope and on the southeastern Plains (Fitzgerald et al. 1994). It is expected to occur in suitable habitats in the Project Area. Within the Project Area, there are 7 acres of riparian/wetland community types under BLM administration that may be suitable for the Yuma myotis (Table K–5).

K.3.7.1.3 Life History

The Yuma myotis is commonly associated with riparian areas throughout its range, even in the Southwest where such features are uncommon. Foraging occurs at low elevation, often just above the surface of lakes, ponds, and streams (Harvey et al. 1999). Prey includes aquatic insects, moths, flies, grasshoppers, and beetles (Fitzgerald et al. 1994). Day roosts are in rock crevices, buildings, caves, mines, and abandoned swallow nests. Night roosts are commonly located in buildings and under bridges or ledges (Harvey et al 1999). Roosts can be quickly abandoned if disturbed. Winter habitat use is poorly documented, but individuals may roost in the summer range or migrate to warmer climates.

K.3.7.1.4 Factors of Concern

This species is of special concern due to its sensitivity to disturbance at roost sites. Recreational caving, mine exploration, renewed mining at historic sites, mine closures, and building and bridge conversion pose threats to roosts. Vegetative conversion, livestock grazing, and other impacts to riparian areas that affect the insect prey base could affect populations of this species.

K.3.7.2 Environmental Baseline

No CBM-related impacts to the Yuma myotis have been documented. Other activities that have occurred in the Project Area, such as agriculture, residential and commercial development, and road construction, may have impacted this species; however, the extent of these impacts and their effects on the Yuma myotis are not known because of a lack of data on the historic and current populations of this species in the Project Area.

K.3.7.3 Effects of the Proposed Project

The types of effects to this species are the same among the different alternatives and only vary according to the amount of disturbed habitats estimated for each alternative. Table K–2 summarizes the amount of disturbance by alternative to suitable Yuma myotis habitats on BLM lands. The five alternatives would not disturb suitable habitats on BLM lands within the Project Area.

Potential impacts to the Yuma myotis caused by implementation of any of the alternatives include disturbance or displacement of individuals from roosts and degradation or destruction of foraging habitats. Construction activities and increased human presence within the Project Area may limit the use of roosting sites, including rock crevices, buildings, caves, mines, and abandoned swallow's nests. Integrated mitigation measures would restrict impacts to riparian/wetland habitats, the preferred foraging habitat for this species. In some instances, construction of roads or utility corridors may occur in these habitats. These actions are not expected to cause impacts to the bat or its prey species. Although undis-

turbed habitats exist within the Project Area, their carrying capacity and suitability to support displaced individuals are unknown. These habitats are assumed to occur within the Project Area and the Yuma myotis is expected to use these habitats without impacts to individual health or population status. Project related activities are not expected to impact the local occurrence or availability of this bat's preferred invertebrate prey species.

Within the cumulative effects analysis area, there are 8,835 acres of suitable riparian/wetland habitats for the Yuma myotis. The cumulative effects resulting from the combination of past oil and gas activities, the alternatives to the proposed project, and the selected alternatives for the SUIT EIS would disturb 506 acres of Yuma myotis habitat. The cumulative disturbance to these habitats accounts for 5.7 percent of this vegetation type in the cumulative effects analysis area. The Yuma myotis uses relatively small-scale unique habitat features as roost sites within the more general habitat categories for which acreage estimates are available. These estimates of general cumulative habitat loss represent an attempt to quantify impacts to Yuma myotis foraging habitats in the cumulative effects analysis area. While it is unlikely that most of these habitats support the Yuma myotis, this analysis gives some indication of the extent of potential cumulative effects to this species. Activities on private lands, such as sand and gravel mining, livestock grazing, agriculture, road construction, and rural and urban housing development would occur in habitats that may support the Yuma myotis. The extent of these impacts, and the potential for them to affect this species, are not quantifiable.

Other cumulative effects to the Yuma myotis, such as reduced habitat effectiveness, vehicle collision, individual mortality, and habitat fragmentation, would occur but are not quantifiable. The level of these effects on public and tribal lands is primarily related to oil and gas development and road use, while on private lands, residential development is also a major factor. For this reason, a trend similar to those examined for habitat is expected for these effects. Mitigation measures designed to avoid effects to the Yuma myotis from all project activities would be implemented and would minimize the potential for any cumulative effects to this species.

K.3.7.4 Additional Recommendations or Mitigation Measures

If potentially suitable roosting habitat is identified within the Project Area, preconstruction surveys would be conducted to determine roost occupancy. Additional mitigation measures would be developed based upon the results of these surveys.

K.3.8 Big Free-tailed Bat

K.3.8.1 Species Information

K.3.8.1.1 Status

The big free-tailed bat is classified as a sensitive species by the BLM in the State of Colorado. The species is uncommon throughout much of its range and is of special concern because of low population sizes.

K.3.8.1.2 Distribution

This species occurs throughout the southwestern United States and Mexico. It is thought to occur throughout Colorado, although existing records imply very low population densities. The species probably does not breed in Colorado, with the few records indicating wandering individuals (Fitzgerald et al. 1994). Autumn records indicate this species may wander hundreds of miles after breeding (Harvey et al. 1999). There are no records of this species from the Project Area, although it is expected to occur in suitable habitats, at least as a rare post-breeding wanderer. Within the Project Area, there are 369 acres of barren community type under BLM administration that may be suitable for the big free-tailed bat (Table K–1).

K.3.8.1.3 Life History

The big free-tailed bat is typically found in rocky country, where it roosts on high cliffs. It has also been known to roost in buildings (Harvey et al. 1999). Individuals in the northern part of the species range are thought to be migratory, as this species is not capable of hibernation (Harvey et al. 1999). Diet consists primarily of moths, although crickets, flying ants, stinkbugs, and leafhoppers are also taken (Harvey et al. 1999).

K.3.8.1.4 Factors of Concern

Disturbance of roost sites is of primary concern for this species. Its low density of occurrence makes protection of existing roost sites extremely important to conservation of this species.

K.3.8.2 Environmental Baseline

No CBM-related impacts to big free-tailed bat have been documented. Other activities that have occurred in the Project Area, such as agriculture, residential and commercial development, and road construction, may have impacted this species; however, the extent of these impacts and their effects on the big free-tailed bat are not known because of a lack of data on the historic and current populations of this species in the Project Area.

K.3.8.3 Effects of the Proposed Project

The types of effects to this species are the same among the different alternatives and only vary according to the amount of disturbed habitats estimated for each alternative. Table K–2 summarizes the amount of disturbance by alternative to big free-tailed bat habitats on BLM lands. Alternative 2 would disturb 6 acres (2

percent) of the habitats under BLM administration within the Project Area, the only alternative with any impacts to habitat for this species.

Potential impacts to the big free-tailed bat caused by implementation of any of the alternatives include disturbance or displacement of individuals from suitable habitats and degradation or destruction of habitats. Construction activities and increased human presence within the Project Area may limit the use of foraging habitats. Roosting habitats, including cliffs, rocky outcrops, and crevices would not be directly disturbed. Construction activities and increased human presence within open habitats may disturb or displace foraging bats. Although the carrying capacity of undisturbed habitats and the suitability of these habitats to support displaced bats are unknown, bats are expected to use these habitats without impacts to individual health or population status. Project related activities are not expected to impact the local occurrence or availability of this bat's preferred invertebrate prey species.

Within the cumulative effects analysis area, there are 2,320 acres of suitable habitats for the big free-tailed bat. Depending on alternative, between 124 and 137 acres of habitats would be cumulatively disturbed by past oil and gas activities, the alternatives to the proposed project, and the selected alternative for the SUIT EIS. The cumulative disturbance to these habitats accounts for 5.3 to 5.9 percent of the available habitats in the cumulative effects analysis area. The big free-tailed bat uses relatively small-scale unique habitat features as roost sites within the more general habitat categories for which acreage estimates are available. These estimates of cumulative habitat loss represent an attempt to quantify impacts to big free-tailed bat habitats in the cumulative effects analysis area. While it is unlikely that most of these habitats support the big free-tailed bat, this analysis gives some indication of the extent of potential cumulative effects to this species. Activities on private lands, such as sand and gravel mining, livestock grazing, agriculture, road construction, and rural and urban housing development would occur in habitats that may support the big free-tailed bat. The extent of these impacts, and the potential for them to affect this species, are not quantifiable.

Other cumulative effects to the big free-tailed bat, such as reduced habitat effectiveness, vehicle collision, individual mortality, and habitat fragmentation, would occur but are not quantifiable. The level of these effects on public and tribal lands is primarily related to oil and gas development and road use, while on private lands, residential development is also a major factor. For this reason, a trend similar to those examined for habitat is expected for these effects. Mitigation measures designed to avoid effects to the big free-tailed bat from all project activities would be implemented and would minimize the potential for any cumulative effects to this species.

K.3.8.4 Additional Recommendations or Mitigation Measures

If potentially suitable roosting habitat is identified within the Project Area, preconstruction surveys would be conducted to determine roost occupancy. Additional mitigation measures would be developed based upon the results of these surveys.

K.3.9 Northern Goshawk

The northern goshawk is discussed in detail in the MIS Analysis (Appendix J).

K.3.10 Bluehead Sucker

K.3.10.1 Species Information

K.3.10.1.1 Status

The bluehead sucker is classified as a sensitive species by the BLM in the State of Colorado. It is also considered a species of special concern by the State of Colorado.

K.3.10.1.2 Distribution

The bluehead sucker is native to the Colorado River Basin, and is also found in parts of the Walker River in Nevada, the Bear and Weber River drainages in Utah and Wyoming, and the upper Snake River drainage in Idaho and Wyoming (Holden 1999). In southwest Colorado, it occurs in areas administered by the San Juan Field Office (BLM 2000). Bluehead suckers inhabit most reaches of the San Juan and Animas Rivers as well as lower reaches of some tributaries (USFWS 1995). The bluehead sucker is expected to occur in suitable habitats in the Project Area; however, none of these habitats are under BLM administration.

K.3.10.1.3 Life History

Bluehead suckers inhabit the relatively cooler, clearer waters of the upper and middle portions of rivers and streams, preferring faster flowing water over rocky substrate (Holden 1999). The high use of these habitats is probably largely related to feeding. These fish possess a rigid upper lip with a cartilaginous ridge, designed for scraping cobble for diatoms and other potential food sources (Woodling 1985). Spawning occurs in June and July, at temperatures above 15°C (Holden 1999).

K.3.10.1.4 Factors of Concern

Changes in flow regimes, habitat loss, and introduction of non-native fish species have the potential to cause the decline of this species. In some waters, this species appears to have been replaced by the introduced white and longnose suckers. Coldwater releases from reservoirs may also have been involved in the disappearance of the bluehead sucker from some western Colorado waters (Woodling 1985).

K.3.10.2 Environmental Baseline

CBM development to date has caused a reduction in surface flows that is discussed in detail in the Surface Water section of chapter 3 of the EIS. In summary, existing CBM development has resulted in water depletion of approximately 65 acre-feet per year (0.09 cfs) from the Animas, Florida, and Pine watersheds (Cox et al. 2001). Mean flows for these rivers at the nearest available gauging stations are 832 cfs, 39 cfs, and 359 cfs for the Animas, Florida, and Pine Rivers, respectively. Existing CBM development has not likely had any noticeable effect

on flows in these three rivers because the depletions are several orders of magnitude smaller than mean flows, and inconsequential compared with daily, monthly, and annual fluctuations caused by natural and artificial factors such as weather events, dam releases, and irrigation water withdrawals. The amount of surface flow reduction that has occurred to date as a result of CBM development is minimal and has not affected fisheries in the Project Area (Japhet 2002). Dewatering of the aquifer as a result of CBM development has not been documented to dry up springs or seeps in the Project Area to date (Janowiak 2002). The minimal depletions associated with existing CBM development have not likely had any effect on the bluehead sucker.

Several factors have caused changes in water quality in the Project Area and downstream in the San Juan River. Spills of CBM produced water have occurred, and the high salinity of these waters has resulted in localized fish kills (Japhet 2002). The BLM has conducted a study evaluating the potential impact of oil and gas activity in the San Juan Basin and concluded that they were not contributing significant levels of PAHs to the San Juan River (Holden 2000).

Methane seeps into rivers and streams in the area do not appear to have affected water quality, although they appear to have increased since CBM development began (Janowiak 2002, Japhet 2002). One exception occurs on the Animas River where hydrogen sulfide (H_2S) was detected at relatively high levels. These levels dissipate within several hundred feet of the seep (Janowiack 2002) and tend to preclude the presence of fish in the immediate area; however, a healthy trout population occurs downstream of this site (Janowiak 2002, Japhet 2002).

It is likely that the construction of roads, pipelines, and well pads has increased sedimentation in the streams and rivers in the Project Area, although there is no documentation of this occurring as a direct result of CBM development (Japhet 2002, Lashmett 2002). There have been no documented impacts directly to the bluehead sucker as a result of these effects of existing CBM development on water quality.

Activities other than CBM development that have occurred in the Project Area, such as agriculture, residential and commercial development, and road construction, have likely had substantial effects on the quantity and quality of water leaving the Project Area. Each of the four major drainages in the Project Area has been subject to substantial residential and agricultural development. The completion of Navajo Dam in 1962 effectively isolated the Pine and Piedra Rivers upstream in the Project Area from the San Juan River. Other diversion structures, including several below the confluence of the San Juan and Animas Rivers, are also potential fish barriers, especially at low flows (USFWS 1995). Collectively, these water development projects have depleted flow, altered flow regimes, changed water temperature and quality, and fragmented habitats within the drainage systems in which this species occurs.

Water quality degradation as a result of past mining activities, irrigation return flows, sediment input from ground-disturbing activities, and urban runoff has occurred in the Project Area. These effects may not have directly impacted the bluehead sucker; however, the cumulative effects of decreased surface flow and water quality may have reduced the quality of habitats and contributed to the de-

creased population levels that ultimately lead to classification of this species as sensitive.

K.3.10.3 Effects of the Proposed Project

No impacts are expected to this species because of the lack of occupied habitats under BLM administration within the Project Area.

The cumulative effects analysis area for the bluehead sucker includes the Project Area and the San Juan River watershed downstream of the Project Area to Lake Powell. Approximately 846,000 acre-feet of water per year are currently being depleted in this area. Included in this total are 66 acre-feet per year that will be depleted by CBM development in the SUIT EIS Study Area immediately south of the Project Area (BLM et al. 2002). The projected depletions associated with the proposed action (200 acre-feet per year) are small relative to total depletions within the basin. Nevertheless, the cumulative effect of all depletions may have had an adverse effect on bluehead sucker.

Decreased water quality caused by increased sediment loads in streams and the minimal potential for spills of fuel, lubricants, drilling fluids, and produced water are not likely to have measurable cumulative effects on the bluehead sucker. Each of these impacts would occur upstream of known populations of this species and thus potential impacts to water quality are unlikely to be measurable in occupied habitats. Other activities, such as sand and gravel mining, livestock grazing, agriculture, road construction, and rural and urban housing development, have likely had a much greater cumulative effect on water quality in the cumulative effects analysis area, especially where these activities occur in close proximity to occupied habitats.

K.3.10.4 Additional Recommendations or Mitigation Measures

A complete list of recommendations and mitigation measures are provided in the EIS. No other measures are suggested for this species.

K.3.11 Flannelmouth Sucker

K.3.11.1 Species Information

K.3.11.1.1 Status

The flannelmouth sucker is classified as a sensitive species by the BLM in the State of Colorado. It is also considered a species of special concern by the State of Colorado.

K.3.11.1.2 Distribution

Endemic to the Colorado River Basin, the flannelmouth sucker has been extirpated from most of its former range in the Lower Basin, especially in the area below Hoover Dam. It is the most abundant native species in the San Juan River (Holden 1999). In southwest Colorado, it is known to occur in areas administered

by the San Juan Field Office (BLM 2000). Flannelmouth suckers inhabit most reaches of the San Juan and Animas Rivers as well as lower reaches of some tributaries (USFWS 1995). This species is expected to occur in suitable habitats in the Project Area; however, none of these habitats are under BLM administration (Woodling 1985).

K.3.11.1.3 Life History

The flannelmouth sucker inhabits larger streams and rivers in all habitat types including riffles, runs, eddies, and backwaters (Woodling 1985). The flannelmouth is a bottom feeder. It spawns in May to August on gravel/cobble bars or riffles.

K.3.11.1.4 Factors of Concern

Changes in flow regimes, habitat loss, and introduction of non-native fish species have the potential to cause the decline of this species. In some waters, this species appears to have been replaced by the introduced white and longnose suckers. Coldwater releases from reservoirs may also have been involved in the disappearance of the flannelmouth sucker from some western Colorado waters (Woodling 1985).

K.3.11.2 Environmental Baseline

The environmental baseline for the flannelmouth sucker is essentially the same as the baseline conditions discussed for the bluehead sucker above. Other than a general decline in populations and the loss of this species from some waters, specific impacts have not been identified.

K.3.11.3 Effects of the Proposed Project

No impacts are expected to this species because of the lack of occupied habitats on BLM lands within the Project Area.

The cumulative effects analysis area for the flannelmouth sucker includes the Project Area and the San Juan River watershed downstream of the Project Area to Lake Powell. Approximately 846,000 acre-feet of water per year are currently being depleted in this area. Included in this total are 66 acre-feet per year that will be depleted by CBM development in the SUIT EIS Study Area immediately south of the Project Area (BLM et al. 2002). The projected depletions associated with the proposed action (200 acre-feet per year) are small relative to total depletions within the basin. Nevertheless, the cumulative effect of all depletions has had an adverse effect on flannelmouth sucker.

Decreased water quality caused by increased sediment loads in streams and the minimal potential for spills of fuel, lubricants, drilling fluids, and produced water are not likely to have measurable cumulative effects on the flannelmouth sucker. Each of these impacts would occur upstream of known populations of this species and thus potential impacts to water quality are unlikely to be measurable in occupied habitats. Other activities, such as sand and gravel mining, livestock grazing, agriculture, road construction, and rural and urban housing development, have likely had a much greater cumulative effect on water quality in the cumula-

tive effects analysis area, especially where these activities occur in close proximity to occupied habitats.

K.3.11.4 Additional Recommendations or Mitigation Measures

A complete list of recommendations and mitigation measures are provided in the EIS. No other measures are suggested for this species.

K.3.12 Roundtail Chub

K.3.12.1 Species Information

K.3.12.1.1 Status

The roundtail chub is classified as a sensitive species by the BLM in the State of Colorado. It is also considered a species of special concern by the State of Colorado.

K.3.12.1.2 Distribution

Found throughout the Colorado River Basin, the roundtail chub was historically common in most tributaries of the Upper Basin. Surveys have found roundtail chub common in sampled sites in the Yampa River and at most sites in the Dolores River, as well as sites in the Green River and Yampa River at Dinosaur National Monument. In southwest Colorado, it is known to occur in areas administered by the San Juan Field Office (BLM 2000). Recent collections on the San Juan River found relatively few roundtail chub, but larger populations were found in several tributaries. It appears that a roundtail chub population does not currently exist in the San Juan River mainstem and that the few individuals collected likely came from tributaries (Holden 1999). This species is expected to occur in suitable habitats in the Project Area; however, none of these habitats are under BLM administration (Woodling 1985).

K.3.12.1.3 Life History

Adult roundtail chubs typically occur in slow moving water adjacent to fast moving water. Generally, groups of adults occur in quiet swirling water and move into fast water to feed. Adults feed on aquatic and terrestrial insects; however, larger chubs will sometimes feed on other fish. The young typically prefer shallow river runs, while juveniles occur in river eddies and irrigation ditches. Spawning takes place over gravel substrates and occurs in early summer (Woodling 1985).

K.3.12.1.4 Factors of Concern

Decline in roundtail chub populations were often correlated to the introduction and establishment of predatory non-native fishes. Low numbers of roundtail chub in the San Juan River may be attributed to the change in water temperature induced by Navajo Dam; however, rotenone was used to eliminate non-game species from approximately 70 miles of the river during 1961, which may have had a long-lasting, negative impact on the local population (Holden 1999).

K.3.12.2 Environmental Baseline

The environmental baseline for the roundtail chub is essentially the same as the baseline conditions discussed for the bluehead sucker above. Other than a general decline in populations and the loss of this species from some waters, specific impacts have not been identified.

K.3.12.3 Effects of the Proposed Project

No impacts are expected to this species because of the lack of occupied habitats on BLM lands within the Project Area.

The cumulative effects analysis area for the roundtail chub includes the Project Area and the San Juan River watershed downstream of the Project Area to Lake Powell. Approximately 846,000 acre-feet of water per year are currently being depleted in this area. Included in this total are 66 acre-feet per year that will be depleted by CBM development in the SUIT EIS Study Area immediately south of the Project Area (). The projected depletions associated with the proposed action (200 acre-feet per year) are small relative to total depletions within the basin. Nevertheless, the cumulative effect of all depletions has had an adverse effect on roundtail chub.

Decreased water quality caused by increased sediment loads in streams and the minimal potential for spills of fuel, lubricants, drilling fluids, and produced water are not likely to have measurable cumulative effects on the roundtail chub. Each of these impacts would occur upstream of known populations of this species and thus potential impacts to water quality are unlikely to be measurable in occupied habitats. Other activities, such as sand and gravel mining, livestock grazing, agriculture, road construction, and rural and urban housing development, have likely had a much greater cumulative effect on water quality in the cumulative effects analysis area, especially where these activities occur in close proximity to occupied habitats.

K.3.12.4 Additional Recommendations or Mitigation Measures

A complete list of recommendations and mitigation measures are provided in the EIS. No other measures are suggested for this species.

K.3.13 Milk Snake

The milk snake is discussed in the Biological Evaluation (Appendix I).

K.3.14 Northern Leopard Frog

The northern leopard frog is discussed in the Biological Evaluation (Appendix I).

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Appendix L

State-Listed Threatened, Endangered, and Special Concern Species Analyses

APPENDIX L

STATE-LISTED THREATENED, ENDANGERED, AND SPECIAL CONCERN SPECIES ANALYSES

NORTHERN SAN JUAN BASIN COAL BED METHANE DEVELOPMENT ENVIRONMENTAL IMPACT STATEMENT

San Juan National Forest
San Juan Field Office, Bureau of Land Management

Archuleta and La Plata Counties

Prepared by:

The San Juan Public Lands Center

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Appendix L — State-listed Threatened, Endangered, and Special Concern Species

L.1 Summary of Evaluation

Twenty-eight species listed by the State of Colorado were initially considered in this evaluation. After examining occurrence information and availability of suitable habitat, 12 of these species were not expected to occur in the Project Area, and therefore removed from further consideration. For each of the remaining 16 species, a complete evaluation was presented including descriptions of protective status, distribution, life history, factors of concern, environmental baseline, effects, and mitigation measures, where appropriate. Five of these species were also evaluated in the Biological Evaluation as Forest Service (FS) sensitive species, three were evaluated in the Biological Assessment as federally listed species, and one was evaluated in the Management Indicator Species (MIS) Assessment as a forest indicator species. Alternative 2 would impact two percent of habitat suitable to the bald eagle and Mexican spotted owl. This impact is the most for any species by any alternative. All other impacts from the alternatives would be one percent or less.

Table L–1 presents acres of suitable habitat affected by each alternative for each of the evaluated State listed species on all lands within the Project Area.

L.2 Wildlife Species Considered but Eliminated from Detailed Evaluation

All wildlife species listed by the State of Colorado as threatened, endangered, or of special concern were evaluated for their potential to occur in the Project Area. Based on this evaluation, it was determined that a number of these species are not expected to occur because the Project Area is either outside of their range and/or does not contain any potential habitat for them. This group of species will not be impacted by the proposed project. These species have been eliminated from further detailed evaluation. The rationale for elimination is discussed for each species below.

Table L–2 presents the State protected species evaluated in this report and the acreage of existing suitable habitat and percentage of suitable habitat available within the Project Area for each species evaluated.

Table L–1 Suitable Habitat for State Listed Species Affected by each Alternative

	Alternative 1		Alternative 1A		Alternative 1B		Alternative 2		Alternative 3		Alternative 4		Alternative 5	
Species	Acres of Suitable Habitat Affected	Percent of Suitable Habitat Affected	Acres of Suitable Habitat Affected	Percent of Suitable Habitat Affected	Acres of Suitable Habitat Affected	Percent of Suitable Habitat Affected	Acres of Suitable Habitat Affected	Percent of Suitable Habitat Affected	Acres of Suitable Habitat Affected	Percent of Suitable Habitat Affected	Acres of Suitable Habitat Affected	Percent of Suitable Habitat Affected	Acres of Suitable Habitat Affected	Percent of Suitable Habitat Affected
Northern leopard frog	3	<1%	3	<1%	3	<1%	3	<1%	3	<1%	3	<1%	3	<1%
New Mexico spadefoot	136	<1%	110	<1%	97	<1%	234	<1%	130	<1%	94	<1%	67	<1%
Southwestern willow flycatcher	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%
Bald eagle	48	1%	43	<1%	469	1%	115	<1%	69	<1%	41	<1%	37	<1%
Mexican spotted owl	447	1%	388	1%	252	<1%	674	2%	274	<1%	257	<1%	109	<1%
Western burrowing owl	143	<1%	118	<1%	106	<1%	251	<1%	132	<1%	100	<1%	68	<1%
Peregrine falcon	506	<1%	411	<1%	316	<1%	970	1%	366	<1%	394	<1%	208	<1%
River otter	3	<1%	3	<1%	3	<1%	3	<1%	3	<1%	3	<1%	3	<1%
Razorback sucker	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%
Colorado pikeminnow	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%
Bluehead sucker	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%
Flannelmouth sucker	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%
Roundtail chub	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%

Table L–2 Species Consideration and Habitat Availability

Species	Evaluate in Detail?	Acres of Suitable Habitat within the Project Area	Percentage of the Project Area that is Suitable Habitat
Boreal toad	No	No Impact	No Impact
Texas horned lizard	No	No Impact	No Impact
Desert spiny lizard	No	No Impact	No Impact
Whooping crane	No	No Impact	No Impact
Greater sandhill crane	No	No Impact	No Impact
Ferruginous hawk	No	No Impact	No Impact
Gunnison sage grouse	No	No Impact	No Impact
Black-footed ferret	No	No Impact	No Impact
Canada lynx	No	No Impact	No Impact
Wolverine	No	No Impact	No Impact
Bonytail chub	No	No Impact	No Impact
Humpback chub	No	No Impact	No Impact
Colorado River cutthroat trout	No	No Impact	No Impact
Northern leopard frog	Yes	857	<1%
New Mexico spadefoot	Yes	25,505	20%
Southwestern willow flycatcher	Yes	673	<1%
Bald eagle	Yes	39,798	32%
Mexican spotted owl	Yes	39,125	31%
Western burrowing owl	Yes	27,152	22%
Peregrine falcon	Yes	73,059	58%
River otter	Yes	857	<1%
Razorback sucker	Yes	183	<1%
Colorado pikeminnow	Yes	183	<1%
Bluehead sucker	Yes	183	<1%
Flannelmouth sucker	Yes	183	<1%
Roundtail chub	Yes	183	<1%

Protection of species listed by the State of Colorado is warranted on all lands within the Project Area, despite administrative boundaries. Accordingly, 125,348 acres within the Project Area was evaluated for impacts to species listed by the State of Colorado. Dominant vegetation types occurring in the Project Area include over 34,000 acres of ponderosa pine 25,000 acres of pinyon-juniper and 18,000 acres of Gambel oak. Table L–3 presents the existing acreage for each of the vegetation types occurring within the Project Area.

L.2.1 Boreal Toad

The boreal toad is listed as an endangered species by the State of Colorado and is a candidate species for federal listing. It is also classified as a sensitive species by Region 2 of the FS. It has been eliminated from detailed evaluation. The rationale for dismissal is discussed in the Biological Evaluation (Appendix I).

Table L–3 Areal Extent of each Habitat Structural Stages Occurring within the Project Area

	Areal Extent by Structural Habitat Stage (acres)												
Vegetation Type	n/a	1M	1T	2S	2T	3A	3B	3C	4A	4B	4C	5	Total
Grasslands	0	9,145	3,613	0	0	0	0	0	0	0	0	0	12,758
Sagebrush	0	0	0	12,012	0	0	0	0	0	0	0	0	12,012
Pinyon-Juniper	0	0	0	0	0	5,807	12,052	0	4,679	3,357	0	0	25,895
Mountain Shrub	0	0	0	2,666	0	0	0	0	0	0	0	0	2,666
Gambel Oak	0	0	0	18,424	495	0	0	0	0	0	0	0	18,919
Ponderosa Pine	0	0	0	0	0	457	963	56	16,876	14,908	99	1,335	34,693
Mixed Conifer	0	0	0	0	0	19	900	113	382	2,667	487	0	4,568
Aspen	0	0	0	0	0	290	425	20	107	448	22	0	1,313
Riparian	0	0	0	74	0	0	0	0	605	0	0	0	679
Agriculture	9,343	0	0	0	0	0	0	0	0	0	0	0	9,343
Barren	2,320	0	0	0	0	0	0	0	0	0	0	0	2,320
Water	183	0	0	0	0	0	0	0	0	0	0	0	183
Total	11,846	9,145	3,613	33,175	495	6,573	14,340	190	22,650	21,378	608	1,335	125,348

L.2.2 Texas Horned Lizard

The Texas horned lizard is considered a species of special concern by the State of Colorado. It is classified as a sensitive species by Region 2 of the FS and the BLM in the State of Colorado. It has been eliminated from detailed evaluation. The rationale for dismissal is discussed in the Biological Evaluation (Appendix I).

L.2.3 Desert Spiny Lizard

The desert spiny lizard is considered a species of special concern by the State of Colorado. It is classified as a sensitive species by the BLM in the State of Colorado.

The desert spiny lizard occurs throughout the southwestern United States and northern Mexico, including the southern part of the Great Basin and Colorado Plateau. This species is known to occur in extreme southwestern Colorado in Montezuma County, at elevations below approximately 5,100 feet (Hammerson 1999). It is not expected to occur in the Project Area. It has been eliminated from detailed evaluation.

L.2.4 Whooping Crane

The whooping crane is listed as endangered by the State of Colorado. It is also a federally-listed endangered species. It has been eliminated from detailed evalua-

tion. The rationale for dismissal is discussed in the Biological Assessment (Appendix H).

L.2.5 Greater Sandhill Crane

The sandhill crane is considered a species of special concern by the state of Colorado. It is also classified as a sensitive species by Region 2 of the FS. It has been eliminated from detailed evaluation. The rationale for dismissal is discussed in the Biological Evaluation (Appendix I).

L.2.6 Ferruginous Hawk

The ferruginous hawk is considered a species of special concern by the state of Colorado. It is also classified as a sensitive species by Region 2 of the FS and the BLM in the State of Colorado. It has been eliminated from detailed evaluation. The rationale for dismissal is discussed in the Biological Evaluation (Appendix I).

L.2.7 Gunnison Sage Grouse

The Gunnison sage grouse is considered a species of special concern by the State of Colorado and is a candidate species for federal listing. It is also classified as a sensitive species by the BLM in the State of Colorado. It has been eliminated from detailed evaluation. The rationale for dismissal is discussed in Appendix K.

L.2.8 Black-footed Ferret

The black-footed ferret is listed as endangered by the State of Colorado. It is also a federally-listed endangered species. It has been eliminated from detailed evaluation. The rationale for dismissal is discussed in the Biological Assessment (Appendix H).

L.2.9 Canada Lynx

The Canada lynx is listed as endangered by the State of Colorado. It is also a federally-listed threatened species. It has been eliminated from detailed evaluation. The rationale for dismissal is discussed in the Biological Assessment (Appendix H).

L.2.10 Wolverine

The wolverine is listed as endangered by the state of Colorado. It is also classified as a sensitive species by Region 2 of the FS. It has been eliminated from detailed evaluation. The rationale for dismissal is discussed in the Biological Evaluation (Appendix I).

L.2.11 Bonytail Chub

The bonytail chub is listed as endangered by the State of Colorado. It is also a federally-listed endangered species. It has been eliminated from detailed evaluation. The rationale for dismissal is discussed in the Biological Assessment (Appendix H).

L.2.12 Humpback Chub

The humpback chub is listed as threatened by the State of Colorado. It is also a federally-listed endangered species. It has been eliminated from detailed evaluation. The rationale for dismissal is discussed in the Biological Assessment (Appendix H).

L.2.13 Colorado River Cutthroat Trout

The Colorado River cutthroat trout is considered a species of special concern by the State of Colorado. It is also classified as a sensitive species by Region 2 of the FS and by the BLM in the State of Colorado. It has been eliminated from detailed evaluation. The rationale for dismissal is discussed in the Biological Evaluation (Appendix I).

L.3 Wildlife Species Evaluated in Detail

The remaining State-listed threatened, endangered, and special concern wildlife species may occur in the Project Area based on known occurrences of, and/or the presence of suitable habitats for, these species. Detailed evaluations of the potential impacts of the proposed project on these species have been conducted and are discussed in the following sections. For each species, general information about the species, including its status, distribution, life history, and factors of concern are reviewed. The environmental baseline includes a summary of past and present impacts of federal, state, and private actions and other human activities in the Project Area (including past and on-going CBM development) on each species. Direct, indirect, and cumulative effects of the proposed project on each species are discussed. Finally, additional mitigation measures beyond those that are integral to the proposed project are recommended.

Table L–4 summarizes the general habitat associations for each of the state listed species evaluated in this report.

L.3.1 Northern Leopard Frog

The northern leopard frog is considered a species of special concern by the state of Colorado. It is classified as a sensitive species by Region 2 of the FS and the BLM in the State of Colorado and is discussed in the Biological Evaluation (Appendix I). Within the Project Area, 857 acres of riparian/wetland and open water community types may be suitable habitat for the northern leopard frog. Refer to Table L–3 for a summary of acreages by habitat structural stage and Table L–4 for species habitat associations.

Table L–4 Species Habitat Associations

Species	Habitat											
	Grassland	Sagebrush	Pinyon-Juniper	Mountain Shrub	Gambel Oak	Ponderosa Pine	Mixed Conifer	Aspen	Riparian/ Wetland	Barren	Water
Northern leopard frog[1]									X		X
New Mexico spadefoot	X	X							X		
Southwestern willow flycatcher[2]									X		
Bald eagle[2]						X	X		X		
Mexican spotted owl[2]						X	X				
Western burrowing owl[1]	X	X								X	
Peregrine falcon	X	X	X	X	X				X		
River otter[3]									X		X
Razorback sucker											X
Colorado pikeminnow											X
Bluehead sucker											X
Flannelmouth sucker											X
Roundtail chub											X

Notes:
1. Life history, effects analysis, and determination provided in the Biological Evaluation.
2. Life history, effects analysis, and determination provided in the Biological Assessment.
3. Life history, effects analysis, and determination provided in the Management Indicator Species Analysis.

L.3.2 New Mexico Spadefoot

L.3.2.1 Species Information

L.3.2.1.1 Status

The New Mexico spadefoot is considered a species of special concern by the State of Colorado.

L.3.2.1.2 Distribution

The New Mexico spadefoot occurs throughout the southwestern United States and into central Mexico. It occurs west into Arizona, east into western Texas and north into southeastern Utah, southern Colorado, and southwestern Kansas (Hammerson 1999). It occurs generally south of the Uncompahgre Plateau in southwestern Colorado and into the Arkansas River valley in southeastern Colorado. It has been documented in both La Plata and Archuleta Counties. Within the Project Area, 25,505 acres of grassland, sagebrush, and riparian/wetland community types may be suitable habitat for the New Mexico spadefoot. Refer to Table L–3 for a summary of acreages by habitat structural stage and Table L–4 for species habitat associations.

L.3.2.1.3 Life History

This species inhabits grasslands and shrublands in proximity to floodplains below 6,500 feet. Like other spadefoot toads, it spends much of its life underground, emerging from the soil and entering water only to breed. Surface activity occurs in Colorado from late spring to early fall, often associated with periods of rain. Temporary rainwater pools are most often used for breeding. A variety of invertebrates are utilized on an opportunistic basis as food (Hammerson 1999).

L.3.2.1.4 Factors of Concern

Populations of the New Mexico spadefoot appear to stable. Clearing of native habitats for agriculture likely reduced populations in the past. Populations near roads may suffer substantial road-kill mortality during active periods (Hammerson 1999). Overall, this species appears to be relatively abundant and not subject to any substantial threats at this time.

L.3.2.2 Environmental Baseline

No CBM-related impacts to this species have been documented. There is the potential for undocumented impacts to have occurred to this species from existing CBM development; however, no data exist to show that undocumented impacts have or have not occurred.

No other impacts to this species have been documented; however, it is likely that this species has been impacted in the past as the result of human presence and disturbance to suitable habitats within the Project Area.

L.3.2.3 Effects of the Proposed Action

The types of effects to this species are the same among the different alternatives and only vary according to the amount of disturbed habitats estimated for each alternative. Table L–1 summarizes the amount of disturbance by alternative to suitable New Mexico spadefoot habitats within the Project Area. Alternative 2 would disturb 234 acres (<1 percent) of the potentially suitable habitat in the Project Area, the most disturbance by any alternative. Alternatives 1, 3, 4, and 5 would each disturb 136 acres (<1 percent) or fewer.

Potential impacts to the New Mexico spadefoot caused by implementation of any of the alternatives may include injury or mortality of individuals and degradation or destruction of suitable habitats. Injury or mortality of individuals may result from trampling or crushing by heavy equipment or vehicle traffic that may occur in suitable habitats. Construction of project facilities would result in a patchwork pattern of disturbance within spadefoot habitats. Project implementation would not impact the occurrence or availability of prey species preferred by the New Mexico spadefoot.

Cumulative effects to the New Mexico spadefoot include the incremental effects of past, present, proposed, and future actions. Impacts from past and present actions, including CBM development, land management activities, and recreational use, were discussed previously in the environmental baseline section. Impacts from the proposed project were also discussed previously. These same impacts are expected to continue in the future within the cumulative effects area and sur-

rounding lands. As a result, increased disturbance to habitats and the potential for alteration of potentially suitable habitats may impact New Mexico spadefoot occurrence and distribution in the Cumulative Effects Area.

L.3.2.4 Additional Recommendations or Mitigation Measures

A complete list of recommendations and mitigation measures are provided in the EIS. No other measures are suggested for this species.

L.3.3 Southwestern Willow Flycatcher

The southwestern willow flycatcher is listed as endangered by the State of Colorado. It is also a federally listed endangered species. This species is discussed in the Biological Assessment (Appendix H). Within the Project Area, 679 acres of riparian/wetland community type may be suitable habitat for the southwestern willow flycatcher. Refer to Table L–3 for a summary of acreages by habitat structural stage and Table L–4 for species habitat associations.

L.3.4 Bald Eagle

The bald eagle is listed as threatened by the State of Colorado. It is also a federally-listed threatened species. This species is discussed in the Biological Assessment (Appendix H). Within the Project Area, 39,940 acres of ponderosa pine, mixed conifer and riparian/wetland community types may be suitable habitat for the bald eagle. Refer to Table L–3 for a summary of acreages by habitat structural stage and Table L–4 for species habitat associations.

L.3.5 Mexican Spotted Owl

The Mexican spotted owl is listed as threatened by the State of Colorado. It is also a federally-listed threatened species. This species is discussed in the Biological Assessment (Appendix H). Within the Project Area, 39,261 acres of ponderosa pine and mixed conifer community types may be suitable habitat for the Mexican spotted owl. Refer to Table L–3 for a summary of acreages by habitat structural stage and Table L–4 for species habitat associations.

L.3.6 Burrowing Owl

The burrowing owl is listed as threatened by the state of Colorado. It is also classified as a sensitive species by Region 2 of the FS and is discussed in the Biological Evaluation (Appendix I). Within the Project Area, 27,090 acres of grassland, sagebrush, and barren community types may be suitable habitat for the western burrowing owl. Refer to Table L–3 for a summary of acreages by habitat structural stage and Table L–4 for species habitat associations.

L.3.7 Peregrine Falcon

L.3.7.1 Species Information

L.3.7.1.1 Status

The peregrine falcon is considered a species of special concern by the State of Colorado. This species was removed from the federal list of endangered species in 1999 (U.S. Fish and Wildlife Service [USFWS] 1999).

L.3.7.1.2 Distribution

The peregrine falcon historically bred in nearly every state in the Union. It thrived for many decades in North America and in the Old World despite extensive persecution by man and human trespass against its habitat. In the early 1950s, breeding populations throughout much of the Northern Hemisphere began an unprecedented and precipitous decline. Peregrine falcons use all forested ecosystems in Colorado during spring, summer, and fall (Towry 1984). There are a number of known active nest sites currently on the SJNF (FS 1998). The Colorado Division of Wildlife (CDOW) has conducted yearly monitoring activities of all known aeries on the SJNF. Associated with monitoring have been surveys for additional peregrine falcons. The FS has conducted surveys, although on a less continuous basis than the CDOW (FS 1998). Sites will continue to be monitored during the five-year post-delisting process. None of these sites occur within the Project Area. Two sites lie in proximity to the eastern side of the Project Area at Chimney Rock and on the lower Piedra River above U.S. Highway 160. Several other nests sites have been observed along the Animas River north of Durango. Foraging activities from these aeries probably extend into the Project Area. Within the Project Area, 72,929 acres of grassland, sagebrush, pinyon-juniper, mountain shrub, Gambel oak, and riparian/wetland community types may be suitable habitat for the peregrine falcon. Refer to Table L–3 for a summary of acreages by habitat structural stage and Table L–4 for species habitat associations.

L.3.7.1.3 Life History

Peregrine habitat may be divided into: 1) nesting sites--the cliff or substrate upon which the eggs are laid and the young are reared; 2) hunting sites--the area where the food is obtained; and 3) migration and wintering areas. Peregrines in the Rocky Mountain and Southwest region now persist mainly on cliffs typically exceeding 200 feet in height. Nests are situated on open ledges or potholes. A preference for a southern exposure increases with latitude (USFWS 1984). On the SJNF, peregrines nest from about 8,000 feet up to about 11,500 feet in elevation.

The peregrine falcon preys on a wide range of avian species. It uses large hunting territories, extending to a radius of 12 to 15 miles from the nest sites. It uses cliffs, rock outcroppings, or other steep rocky areas for resting cover. A peregrine's hunting range is often skewed to favor watercourses (Towry 1984). Preferred hunting habitats include such areas as cropland, meadows, river bottoms, marshes, and lakes because of the abundant bird life typically found there (USFWS 1984).

Pairs are usually present on the nesting cliff by mid-March. The young remain in the area several weeks after fledging in mid-June to mid-July, during which time they are fed and defended by both adults (USFWS 1984). Because peregrines are extremely sensitive to disturbance during the egg-laying, incubation, and brood-rearing periods, protection from disturbances is essential to reproductive success (Towry 1984).

A variety of predators are known or suspected to prey on peregrines or their eggs. These include great horned owls, prairie falcons, raccoons, coyotes, foxes, golden eagles, ravens, crows, gray wolves, arctic ground squirrels, ringtails, striped skunks, bobcats, opossums, black snakes, and possibly ospreys (USFWS 1984).

L.3.7.1.4 Factors of Concern

Substantial alterations in vegetative structure can reduce prey species richness and density. Peregrines are extremely sensitive to human disturbance in proximity to active nest. Abandonment of eggs or nestlings can result from even minor amounts of human disturbance.

L.3.7.2 Environmental Baseline

No CBM-related impacts to this species have been documented. There is the potential for undocumented impacts to have occurred to this species from existing CBM development; however, no data exist to show that undocumented impacts have or have not occurred.

No other impacts to this species have been documented; however, it is likely that this species has been impacted in the past as the result of human presence and disturbance to suitable nesting and foraging habitats within the Project Area.

L.3.7.3 Effects of the Proposed Action

The types of effects to this species are the same among the different alternatives and only vary according to the amount of disturbed habitats estimated for each alternative. Table L–1 summarizes the amount of disturbance by alternative to suitable peregrine falcon habitats within the Project Area. Alternative 2 would disturb 970 acres (1 percent) of the potentially suitable habitat in the Project Area, the most disturbance by any alternative. Alternatives 1, 1A, 1B, 3, 4, and 5 would each disturb 411 acres (<1 percent) or fewer.

Potential impacts to the peregrine falcon caused by implementation of any of the alternatives include disturbance or displacement of peregrine falcons and their prey species. Human presence and construction activity associated with the alternatives may disturb or displace nesting and foraging individuals. Suitable prey species may also be disturbed or displaced caused by human activity and alteration some habitats. The occurrence and availability of prey would not be detrimentally affected by project related actions because of the ubiquitous nature of most prey species and the assumption that undisturbed habitats would be suitable and capable of supporting displaced prey species.

Cumulative effects to the peregrine falcon include the incremental effects of past, present, proposed, and future actions. Impacts from past and present actions, including CBM development, land management activities, and recreational use, were discussed previously in the environmental baseline section. Impacts from the proposed project were also discussed previously. These same impacts are expected to continue in the future within the cumulative effects area and surrounding lands. As a result, increased disturbance to habitats and the potential for increased human presence in previously undisturbed and unoccupied habitats may impact peregrine falcon occurrence and distribution in the cumulative effects area.

L.3.7.4 Additional Recommendations or Mitigation Measures

Conduct pre-construction surveys for the peregrine falcon in all suitable habitats that would be disturbed. If pre-construction surveys identify active peregrine falcon nests, additional mitigation measures should be developed. These measures may include relocation of the proposed well or facility location, avoidance of identified nesting habitats during the appropriate season, and minimization of activities that may disturb peregrine falcon habitats, including identification and preservation of active nests. Survey results should be reported to, and approved by, the Authorized Officer prior to commencement of ground disturbance.

L.3.8 River Otter

The river otter is listed as endangered by the State of Colorado. This species is discussed in the MIS analysis (Appendix J). Within the Project Area, 862 acres of riparian/wetland and open water community types may be suitable habitat for the river otter. Refer to Table L–3 for a summary of acreages by habitat structural stage and Table L–4 for species habitat associations.

L.3.9 Razorback Sucker

The razorback sucker is listed as endangered by the State of Colorado. It is also a federally-listed endangered species. This species is discussed the Biological Assessment (Appendix H). Within the Project Area, none of the 183 acres of open water habitats are considered suitable for this species. Refer to Table L–3 for a summary of acreages by habitat structural stage and Table L–4 for species habitat associations.

L.3.10 Colorado Pikeminnow

The Colorado pikeminnow is listed as threatened by the State of Colorado. It is also a federally-listed endangered species. This species is discussed in the Biological Assessment (Appendix H). Within the Project Area, none of the 183 acres of open water habitats are considered suitable for this species. Refer to Table L–3 for a summary of acreages by habitat structural stage and Table L–4 for species habitat associations.

L.3.11 Bluehead Sucker

The bluehead sucker is considered a species of special concern by the State of Colorado. It is also classified as a sensitive species by the BLM in the State of Colorado and is discussed in Appendix K. Within the Project Area, none of the 183 acres of open water habitats are considered suitable for this species. Refer to Table L–3 for a summary of acreages by habitat structural stage and Table L–4 for species habitat associations.

L.3.12 Flannelmouth Sucker

The flannelmouth sucker is considered a species of special concern by the State of Colorado. It is also classified as a sensitive species by the BLM in the State of Colorado and is discussed in Appendix K. Within the Project Area, none of the 183 acres of open water habitats are considered suitable for this species. Refer to Table L–3 for a summary of acreages by habitat structural stage and Table L–4 for species habitat associations.

L.3.13 Roundtail Chub

The roundtail chub is considered a species of special concern by the State of Colorado. It is also classified as a sensitive species by the BLM in the State of Colorado and is discussed in Appendix K. Within the Project Area, none of the 183 acres of open water habitats are considered suitable for this species. Refer to Table L–3 for a summary of acreages by habitat structural stage and Table L–4 for species habitat associations.

L.4 References Cited

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